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AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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For related information see also *34 Fluid Mechanics and Heat Transfer*.

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For related information see also *34 Fluid Mechanics and Heat Transfer*.

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For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion*.

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82 DOCUMENTATION AND INFORMATION SCIENCE 2885
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software.*

83 ECONOMICS AND COST ANALYSIS 2886
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 2887
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 2887
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

88 SPACE SCIENCES (GENERAL) 2890

89 ASTRONOMY 2890
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 2890
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 2891
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

92 SOLAR PHYSICS 2893
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 2893
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

GENERAL

99 GENERAL 2894

Note: N.A. means that no abstracts were assigned to this category for this issue.

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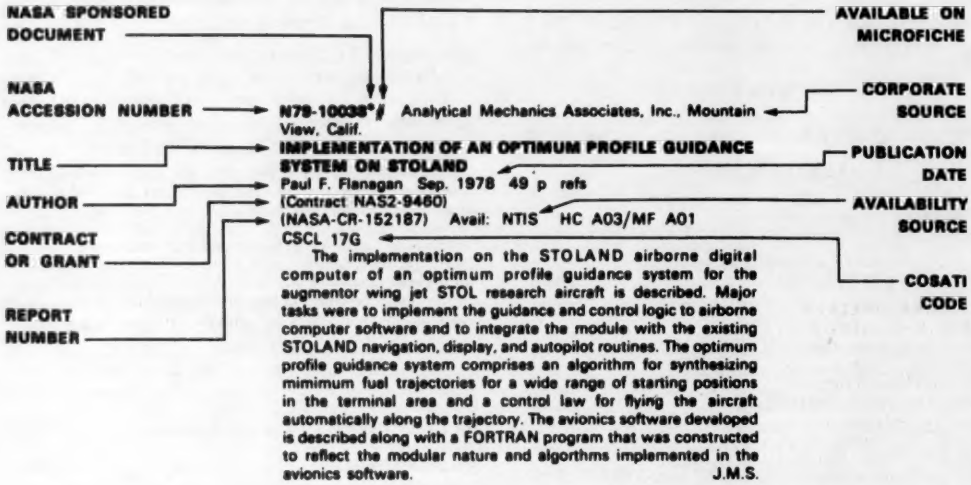
TYPICAL CITATION AND ABSTRACT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N79-10038*# Analytical Mechanics Associates, Inc., Mountain View, Calif.
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TITLE
IMPLEMENTATION OF AN OPTIMUM PROFILE GUIDANCE SYSTEM ON STOLAND
PUBLICATION DATE
AUTHOR
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The implementation on the STOLAND airborne digital computer of an optimum profile guidance system for the augmentor wing jet STOL research aircraft is described. Major tasks were to implement the guidance and control logic to airborne computer software and to integrate the module with the existing STOLAND navigation, display, and autopilot routines. The optimum profile guidance system comprises an algorithm for synthesizing mimimum fuel trajectories for a wide range of starting positions in the terminal area and a control law for flying the aircraft automatically along the trajectory. The avionics software developed is described along with a FORTRAN program that was constructed to reflect the modular nature and algorithms implemented in the avionics software. J.M.S.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, EXAMINATION OF COMMERCIAL AVIATION OPERATIONAL ENERGY CONSERVATION STRATEGIES
Unknown, Aerospace Corp., *P.O. Box 95085, Los Angeles, California* 90045 (1101)

The objectives of this study are: (1) to examine and quantify fuel savings realizable through implementation of various non-hardware energy conservation strategies; (2) to rate and rank each strategy in a manner which will clearly indicate viable strategies and their relative fuel conservation potentials; (3) to select the most promising strategies for further, more comprehensive study; (4) to transfer the study results to appropriate industry and government groups; and (5) to document all significant study results. The objectives will be achieved by reviewing and evaluating related study efforts and coordinating with the industry, government and university sectors. A workshop will be conducted at the end of the study to report results to representatives of industry, government and universities.

SUPPORTED BY U.S. Dept. of Energy, Div. of Transportation Energy Conservation

1.0002, HIGH-SPEED EJECTORS
M. Alperin, Flight Dynamics Research Corp., *Burbank, California* (DF141080; F33615-77-C-3160)

An analysis of ejectors for possible applications at high speeds in the subsonic, transonic and supersonic range will be developed. Various relevant aero thermo fluid dynamic aspects will be introduced in the analysis in a systematic fashion so that realistic configurations can be designed. The analysis will derive ejector performance characteristics at conditions corresponding to flight environments of various altitude and speed ranges, so that ejector applications in a variety of Air Force systems such as aircraft, missiles, etc. can be investigated.

The analysis will include compressibility effects. Although the overall analysis will be based on one-dimensional calculations, two dimensionalities will be accounted for in the considerations of losses arising due to skin friction, shocks, etc. The non-linear conservation equations will be solved iteratively.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0003, FLEXLODS - BLENDED WING/BODY
J.J. Hosek, General Dynamics Corp., *1075 W. Mission Blvd., Pomona, California* 91766 (DF139800; F33615-77-C-3030)

The accurate prediction of loads on any aircraft configuration utilizing multiple lifting surfaces is one of the most difficult problems that the structural loads engineer encounters. This is especially true with the introduction of new technologies such as wing-body blending, vortex lift, variable camber, supercritical airfoils, and advanced flight control concepts. This program shall be one of assessing the most advanced theoretical aerodynamic operators and load prediction techniques that can be used in accurately predicting the structural loads for advanced flight vehicles utilizing known advanced design technologies. Extensive use of configurations utilizing the above technology advancements will be covered and the load prediction techniques evaluated as to their credibility for use in design and evaluation.

In recent years the aerodynamic loads theories based on finite element approaches provided significant advances in the state-of-the-art for predicting interference effects such as those produced by wing-body-tail and/or external stores. Currently there are two well-known methods available which have the capability for predicting the aerodynamic pressures involving multiple surfaces and external stores. These are: (1) doublet lattice (2) Woodward method. Recent methods that are an improvement over those above have been developed but they do not include external store effects. These are: (1) improved Woodward method (2) effect of symmetrical vortex shedding on longitudinal aerodynamic characteristics of wing-body-tail combinations. The former two methods are routinely used in all phases of design. However, neither method has been extensively evaluated as to its general capability for predicting accurately the pressure distribution on configurations employing advance technologies. A systematic comparison will be made of the methods discussed above with experimental data on a variety of aircraft configurations that employ new technologies such as wing-body blending, variable camber, lifting body concepts. These comparisons are to be made at design maneuver loads throughout MIL-A-008860 (USAF) V-N diagram requirements. The results will be collected into a single report and evaluations made on the basis of accuracy and stability for various classification of problems. Necessary corrections will be made to the aerodynamics and/or structural loads prediction modules of the FLEXLODS computer program.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0004, REVISION OF USAF GUIDE FOR AERODYNAMIC DECELERATOR DESIGN AND PERFORMANCE
H.W. Bixby, Irvin Industries Inc., *Gardena, California* (DF133950; F33615-75-C-3081)

The USAF parachute handbook has been the single most important document utilized by personnel associated with the development and application of parachute subsystems. The most recent publication is eleven years old and its content is largely obsolete due to state-of-the-art advances and completely void steerable parachute technology information. Revision of this document to reflect the latest state-of-the-art of parachute design and performance prediction and wide dissemination to government agencies and industry will aid significantly in the expeditious development of effective and reliable parachute subsystems for military applications.

Individual chapters of the current document will be revised in sequence with initial documentation efforts in those areas where technology advances are not currently in progress. A new chapter reflecting steerable parachute technology will be generated. Data sources will include reference documents and personal contacts with knowledgeable personnel in the areas under consideration. Cooperation from DOD and NASA agencies as well as industry is anticipated. Compilation of all data and information in a single document is envisioned.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0005, COMPLETION OF FABRICATION OF IMPROVED ICE PROTECTED UH-1H ROTOR BLADES AND FLIGHT TEST SUPPORT OF SIMULATED AND NATURAL ICING TESTS

R.H. Cotton, Lockheed Aircraft Corp., *2555 N. Hollywood Way, P.O. Box 551, Burbank, California* 91503 (DA0D4080; DAAJ02-77-C-0002)

The objectives of this contract are to complete fabrication of new deiced rotor blades, improve various components of the UH-1H ice protection system, and to support government-conducted simulated and natural icing tests.

Contractor flight test personnel will assist in flight-test planning, perform maintenance of the peculiar hardware of the ice protected, R&D, UH-1H helicopter, process and analyze flight test data and prepare a test report upon completion of the test program. The test report will be published by this directorate. Testing to be conducted by the government includes simulated icing tests using the Ottawa spray rig, operated by the Canadian National Research Council (NRC) and natural icing tests in the vicinity of Ottawa, Canada.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0006, AIR DATA STUDY (VTOL AND V/STOL)

B. Mellinger, Signal Companies Inc., Air Research Manufacturing Company, *2525 W. 190th St., Torrance, California* 90509 (DN881387; N62269-77-C-0253)

To develop an air data system to meet the special requirements of VTOL and V/STOL (vertical and short takeoff and landing) aircraft. This contract supports work unit ZA601, Agency Accession No. DN681080.

Survey and document current mission requirements and deficiencies in air data information. Review related crash and safety reports. Determine requirements not being met by use of conventional aircraft technology and determine technologies available to meet the unique requirements of VTOL and V/STOL aircraft in the future. Prepare development specification requirements.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0007, UNSTEADY GAS DYNAMICS PROBLEMS RELATED TO FLIGHT VEHICLES

H. Ashley, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (DF038980; AFOSR-74-2712)

AF function - advanced aerospace vehicles. Opportunity - remove penalties in performance and airframe weight present in many Air Force aircraft because of limitations imposed by aeroelastic instability and response. Objective - improvement in the theoretical understanding of unsteady aerodynamic loads related to flight vehicles, as well as of aeroelastic phenomena in which they are involved. How work contributes -by providing the design analysts of fixed and rotary-wing aircraft with improved tools, whereby aeroelastic penalties in performance and aircraft weight can be reduced.

The fundamental principles of aerodynamics and structural dynamics will be applied in ways more sophisticated than before which take into account the increased computational capabilities of the new computers. Work planned for the immediate future will consider generalized unsteady aerosynamic forces, chordwise and arbitrary time dependent, and their effects on the aeroelastic stability of lifting surfaces, fixed as well as rotational.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

1.0008, IDENTIFICATION OF KEY MANEUVER LIMITING FACTORS

I.L. Ashkenas, Systems Technology Inc., *13766 S. Hawthorne Blvd., Hawthorne, California* 90250 (DF136880; F33615-76-C-3072)

This work unit supports TPO 3, Flight Control and major thrust FG02B, Flight Control System Design Techniques. Specifically it addresses the problem area involving those high-angle-of-attack aircraft dynamics which result in dangerous stall/post-stall characteristics and limit combat effectivenss and may cause loss of both aircraft and crew. The objective of this effort is to study the characteristics of several fighter and attack aircraft to determine key high-angle-of-attack maneuver limiting factors and postulate solutions for these limitations. The results of this effort will help to understand the high-angle-of-attack dynamics problem thus allowing solutions to be found which will increase combat effectiveness and safety of flight for future fighter and attack aircraft.

Analysis of high-angle-of-attack aerodynamic data, flight-test time histories, and operational experience will be conducted on several aircraft to identify key high-angle-of-attack maneuver-limiting design methodology will be postulated to alleviate the limiting conditions based on identified parameters. The results will be validated and further investigated in a manned simulation of the aircraft and control system dynamics used in the analysis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0009, DEVELOPMENT OF NAVY V/STOL FLYING QUALITIES DESIGN CRITERIA

R. Hoh, Systems Technology Inc., *13766 S. Hawthorne Blvd., Hawthorne, California* 90250 (DN881370; N62269-77-C-0038)

To identify in priority order specific areas in need of improvement in MIL F 83300 and to develop recommended new or revised criteria in selected areas. This contract supports work unit ZA601, Agency Accession No 681080. The contractor will perform an investigative analysis resulting in recommended V/STOL flying qualities criteria applicable to proposed Navy V/STOL sea-based prioritization of deficiencies, investigation of alternate new criteria, recommendations for additional criteria verification.

The contractor will perform an investigative engineering analysis resulting in recommended V/STOL flying qualities criteria applicable to proposed Navy V/STOL sea-based aircraft. The analysis will include: a. Review of operational requirements; b. Prioritization of deficiencies; c. Investigation of alternate/new criteria; d. Recommendations for additional criteria verification.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0010, ADVANCED PERSONNEL PARACHUTE HARNESS

D. Goodrich, U.S. Dept. of Defense, Navy, National Parachute Test Range, *El Centro, California* 92243 (DN795406)

To provide the fleet with an improved restraint harness having superior comfort, 15-20% lower bulk/weight, improved fire resistance, ease of donning/doffing, and thermal comfort. Also to reduce pressure points in the buttocks area and provide easier crash/ditch escape by use of a single-point release system.

Conduct a study of past and present harness designs to eliminate potential deficiencies, identify desirable features for incorporation into the design of an advanced harness/restraint system and evaluate needs with respect to new aircraft designs. Based on the results of this study, design one or more harnesses incorporating the desired characteristics then conduct structural integrity and fit and comfort tests. Emphasis will be placed on: (1) a harness design with maximum adjustability for improved comfort and minimum number of sizes; (2) use of advanced harness materials such as 'kevlar' to provide reduced bulk, fewer pressure points, improved durability, and increased heat-/fire-resistance; and (3), design more efficient, lighter-weight hardware including possible use of a single-point harness release.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0011, PARACHUTE CONTAINER CLOSURE - NEW TECHNOLOGY

D. Goodrich, U.S. Dept. of Defense, Navy, National Parachute Test Range, *El Centro, California* 92243 (DN895420)

Provide an improved parachute container closure device, suitable for aircrew emergency escape equipment, in increasingly higher-performance environments.

Design and demonstrate prototype closure concepts suitable for incorporation in both emerging and future parachute container configurations. (a) Innovative materials and fabrication techniques such as low-friction plastics and permanent impregnation of metal parts with lubricant will be identified and utilized as appropriate. (b) Mechanical elements such as force multipliers, or ball and detent locks will be considered as a means of accommodating a high shear force on the closure without the penalty of an excessive actuation force. (c) Invite industry participation to devise prototypes or production versions, evaluate candidate designs using laboratory and flight tests. Document results and prepare design spec.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0012, AIRFIELD SOIL STABILIZATION

L.P. Gulick, U.S. Dept. of Defense, Navy, Naval Weapons Center, *China Lake, California* 93555 (DN882450)

The objective of this program is the characterization and demonstration of the use of aqueous polymer emulsions to create helicopter/V/STOL pads and to stabilize the soil along expeditionary airfields.

Phase I will investigate application techniques including soil preparation, soil characteristics, water content of the soil, polymer concentration, and application method. The final product of this phase will be a 10,000 sq ft helicopter/V/STOL landing pad for evaluation. Civil engineering laboratory personnel have agreed to assist with consultation and evaluation of suitability.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Surface Weapons Center

1.0013, REDUNDANT RECONFIGURABLE DIGITAL FLIGHT CONTROL SYSTEM

Unknown, U.S. National Aeronautics & Space Admin., Office of Aeronautics & Space Technology, Ames Research Center, *Moffett Field, California* 94035 (FA77WAI-738; FA160016 (TRAIS NO.))

Provide technical services and support to the NASA/ARC Redundant Reconfigurable Digital Flight Control System (RRDFCS) program to provide specific data on digital avionics systems for the FAA.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0014, VERIFICATION OF ADVANCED VIBRATION TEST CONCEPT UTILIZING SIMULATED HUB FORCES

R. Jones, Kaman Aerospace Corp., *Old Windsor Rd., Bloomfield, Connecticut* 06002 (DA0D4111; DAAJ02-77-C-0027)

Demonstrate the applicability of a technique known as force determination for determining helicopter hub loads (vibrator forces and moments) directly from measured fuselage accelerations and establish a method for conducting ground-based test conditions, known as 'ground-flying,' that duplicate in-flight vibratory loads and responses in a helicopter system.

A full-scale Army inventory helicopter will be flight-tested to record fuselage responses, and calibrated in a ground vibration (shake) test. Using the calibrated response mobility matrix and the measured in-flight fuselage responses, determine the in-flight hub loads (vibratory forces and moments). Shake test the vehicle using these hub loads, comparing the in-flight and shake test responses thereby verifying the technique.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0015, FULL-SCALE STATIC TESTING OF AN INTERNAL MIXER FOR THE PRATT AND WHITNEY JT8D AIRCRAFT ENGINE

Unknown, United Technologies Corp., Pratt & Whitney Division, *400 Main St., East Hartford, Connecticut* 06108 (FA77WA-4048; FA160425 (TRAIS NO.))

The mixer shall be installed on a JT8D engine and tested on a performance stand to establish an acceptable engine primary/secondary match. With the mixer hardware in this properly matched position, engine flow parameters such as corrected thrust, N1, N2, EPR, EGT, NPR, airflow, bypass ratio etc., shall be determined. Engine parameter data shall be acquired for at least ten thrust settings approximately equally spaced from idle to JT8D takeoff power.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0016, WIND-TUNNEL EVALUATION OF AN AEROELASTICALLY CONFORMABLE ROTOR

R. Blackwell, United Technologies Corp., Sikorsky Aircraft Division, *N. Main St., Stratford, Connecticut* 06602 (DA0E3778; DAAJ02-77-C-0047)

Investigate the ability to improve rotor operational qualities (i.e., performance, efficiency, loads, stability and handling qualities) by deliberately designing aeroelastic properties to exploit the inherent tendency for blades to deform elastically. Determine if significant practical improvement can be made in rotor operational qualities, reliability and maintainability, and cost. This effort will be directed toward generation of advanced data pertinent to advanced Army aircraft, including UTTAS, AAH, and ASH.

Conduct thorough review of effects of aeroelastic properties on rotor operational qualities. Select specific significant parameters and objectives which can be evaluated with existing technological capability. Perform rigorous phenomenological studies of the results of parameter variations using advanced analytical tools. Design and fabricate wind-tunnel models, and perform comprehensive tests to substantiate analytical findings. Carefully review results to determine specific parametric trends for improving rotor design. Where practical, interpret trends in terms of full-scale design characteristics which may be applied in aircraft development.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0017, ANALYSIS OF HELICOPTER MAINTENANCE FAULT ISOLATION CRITERIA/TECHNIQUES

Unknown, United Technologies Corp., Sikorsky Aircraft Division, *N. Main St., Stratford, Connecticut* 06602 (DA0E3794; DAAJ02-77-C-0071)

The objective of this effort is to establish a clear relationship between failure symptoms to failed component and to develop an effective criteria/technique to indicate same.

To meet the above objective, the following will be accomplished: (1) identify major troubleshooting problem areas according to operational impact (safety, mission reliability, availability, etc.); (2) quantify the identified problem areas in terms of maintenance effort and cost; (3) analyze the identified problem area to establish symptom to failed component relationships and to determine the deficiencies in existing criteria/techniques; (4) develop a maintenance procedure and equipment (diagnostic) criteria/technique which can clearly identify symptom or problems; (5) develop a program for verification of improved criteria/technique for the correction of noted problems.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0018, EFFECTS OF DISTORTED INFLOW ENTERING A FAN IN A TILT NACELLE

B.S. Seidel, University of Delaware, School of Engineering, Dept. of Mechanical & Aerospace Engineering, *Newark, Delaware* 19711 (NSG 3270)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0019, DEVELOPMENT OF COMPUTER-GENERATED PHENOGRAMS TO FORECAST REGIONAL CONDITIONS HAZARDOUS TO LOW-FLYING AIRCRAFT

W.E. Southern, Northern Illinois University, School of Liberal Arts & Sciences, Dept. of Biological Sci, *DeKalb, Illinois* 60115 (DF049880; AFOSR-77-3431)

AF function - bird strikes continue to pose a major hazard to aviation, especially to high-speed, low-altitude aircraft. The cost of bird strikes in civilian and military aviation vastly exceeds that of any agricultural or other economic problem created by birds. Deficiency - military aircraft often fly at low altitudes and at high speeds to avoid radar detection. Bird concentrations by non-migratory species are relatively easier to anticipate than migrating species and thus certain precautionary measures can be taken. Migrant species are not present during all seasons but may be locally abundant near air bases or within flight lanes during specific months. Objective - to accurately depict the seasonal range of each of 20 species of gulls and terns common to the United States and to relate this information to the location of Air Force bases, to describe the monthly schedule and density of larid migration. Weekly analysis will be provided for air bases having a high potential for bird/aircraft problems, to ascertain the population density for gulls and terns in each region of the United States during each month, to determine the geographic origin of gulls responsible for hazards to aircraft at specific bases, to provide a quantitative basis for assessing hazards levels at various locations. How research contributes - this research will support research objectives contained in subarea 1.8, 'Biological Contributions to Air Force Effectiveness'.

Band encounter data for gulls will be analyzed by a FORTRAN program that sorts data into any of 12 categories and plots encounter sites on overlay maps of North America. Information obtained from several sources will be used to prepare phenograms that can serve as an advance warning system for flight officers and/or pilots. Prior to flights it will be possible to recognize possible hazardous areas, to determine the extent of the risk, to select alternate routes if necessary, and to know the approximate duration of dangerous bird concentrations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

1.0020, AUTOMATED TERMINAL SERVICE (ATS) SUPPORT IN THE AREA OF THE ATS OPERATING SYSTEM RSX-11M

Unknown, Automated Sciences Group Inc., *8555 16th St., Suite 713, Silver Spring, Maryland* 20910 (FA78WAI-832; FA161212 (TRAIS NO.))

An Automated Terminal Service (ATS) system to serve as an alternative to new towers at airports reaching tower eligibility. ATS provides traffic advisory management, and threat detection services to achieve the safety of a newly installed tower. The contractor shall provide support for maintaining the overall performance of the ATS-RSX-11M operating system as issued and documented by Digital Equipment Corporation. This responsibility has two parts: (1) system generation, and (2) system diagnostic testing. The supporting activity has three parts: (1) patching system programs, (2) modifying existing system programs to meet environment considerations, and (3) integrating new system programs into the RSX-11M operating system.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0021, NAVY ENVIRONMENT - BALLOON COMMAND/CONTROL

T.J. Rosenberg, University of Maryland, College Park Campus, Inst. for Physical Science & Technology, *College Park, Maryland* 20742 (DN775435; N00014-77-C-0423)

Navy high-altitude scientific balloon operations must conform to air traffic control regulations in order to insure safety of flight for manned aircraft and safety of persons on the ground. To this end command control and flight following are essential to safe balloon operations. This effort is directed at developing a reliable, low-cost command ranging system to be flown on scientific balloon flights.

The contractor is developing a frequency-modulated, sixteen-bit, self-clocking pulse-modulated (PCM) system as a balloon flight control and positioning unit. This action provides for an additional unit to be provided under the contract for testing purposes.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

1.0022, ADAPTIVE CONTROL OF WING/STORE FLUTTER

C.A. Harvey, Honeywell Inc., *600 2nd St. N.E., Hopkins, Minnesota* 55343 (DF140580; F33615-77-C-3096)

Fighters which are required to carry many combinations of external stores for various missions may have performance restrictions to avoid dangerous wing/store flutter instabilities. Conventional techniques (adding stiffness or ballast weight) to prevent flutter are generally not practical to suppress flutter when many external stores are added because one such 'fix' cannot solve all the many unstable modes which occur. The objective of this program is to study and evaluate active flutter suppression concepts which use adaptive feedback. Such a system should prevent many types of flutter modes for a wide variety of external stores and thus permit an unrestricted flight envelope.

A study will be conducted to evaluate the feasibility, practicality and potential application of various methods for adapting the feedback compensation of an active control system for suppressing wing/store flutter. Design criteria, methods for obtaining key flight/airframe data, decision mechanisms, complexity, important trade-offs, etc., will be established for each viable approach studied. The most promising approach for application to wing/store flutter suppression will be determined.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0023, F-4 RESPONSE TO GROUND-INDUCED LOADS

N.H. Zimmerman, McDonnell Douglas Astronautics Co., *E. 411 St., St. Louis, Missouri* 63166 (DF142310; F33615-78-C-3222)

The basic mission of this overall effort is to determine the dynamic response of combat-loaded aircraft while operating on bomb-damaged runways (BDR) that have been repaired in accordance with established procedures (AFR 93-2). Computer simulation studies have shown that under certain runway repair conditions, structural failures may occur to these aircraft (in this case, the F-4C). The objective of this study, then, is to verify the computer simulation studies and the failure criterion used in these studies. Runways are primary targets in a conflict. If our established runway repair procedures may cause aircraft structural failures, our Tactical Commands' emergency response capabilities could be adversely affected.

The approach to be used will be to perform an independent computer analysis, simulating the same conditions as the previous study to verify results. In addition, the 'safe/unsafe' structural failure criterion used in the earlier study will be confirmed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0024, OPTIMIZATION OF STRUCTURES USING FORCE METHOD OF FINITE-ELEMENT ANALYSIS

R.A. Gellatly, Bell Aerospace Co., *P.O. Box 1, Buffalo, New York* 14240 (DF139490; F33615-77-C-3032)

The use of automated design of structural components contributes significantly to the effectiveness and efficiency of flight vehicles. There is a need to develop a method to design an aerospace vehicle with specific strength and stiffness requirement. This will provide an analytical tool for minimum weight design of the structure thus improving the performance and cost of the aerospace vehicle.

The method will be based on the force method of finite-element analysis and the optimality criteria for a minimum weight structure. The use of force method will reduce the number of iterations needed in the design procedure.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0025, TASK IV X-22A FLIGHT RESEARCH PROGRAM
J.L. Beilman, Calspan Corp., *1422 Genesses Ave., P.O. Box 235, Buffalo, New York* 14221 (DN781297; N62269-76-C-0370)

The Task IV X-22A flight research program, scheduled to be completed in September, has the objective of expanding the operational capability of VTOL aircraft under adverse weather conditions. In particular, the Task IV program will concentrate on improving the IFR approach and landing capability of the AV-8B advanced Harrier (the current AV-8A minima are 400 ft. ceiling and 3000 ft. visibility). This is the only in-flight simulation effort currently defined in this area and is being coordinated with the NAVTOLAND Project Office, PMA-257 (Harrier Office) and MCAIR. This contract supports work unit ZA601, Agency Accession No. DN 681080.

The proposed experiment will investigate a matrix of control, display and task variables during an extensive ground simulation phase followed by an in-flight simulation and evaluation phase. The in-flight simulation will be used to validate selected ground simulator configurations and investigate IFR to VFR transition.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0026, 400 TO 600 KNOT EJECTION PROTECTION
T. Thommasson, Stencel Aero Engineering Corp., *Asheville, North Carolina* (DN881496; N62269-77-R-0251)

Investigate and deveop systems and or techniques to provide personnel protection from aerodynamic forces in the 400 to 600 knot speed range. This contract supports work unit ZA601, Agency Accession No. 681080.

Investigate the requirements for high g ejection escape. Define aerodynamic and deceleration forces developed on the man seat recovery system and their effects upon the escape and suvivability of the aviator. Develop equipment for maximizing high g survivability without impairment of low-speed escape performance.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0027, MODULE DEVELOPMENT FOR THE STAGING SYSTEM
L.E. Hulbert, Battelle Memorial Inst., *505 King Ave., Columbus, Ohio* 43201 (DF138240; F33615-76-C-3125)

The use of finite-element methodology in the design of structural components contributes significantly to the effectiveness and efficiency of flight vehicles. There is a need to accelerate the data handling requirements normally associated with using this methodology. The objective of this effort will be directed toward the enhancement of the Air Force staging system by providing new modules, postprocessing and materials data base, not yet developed, by enhancing the display and edit and the generalized data base modules already developed, and by providing a limited number of analysis modules for evaluation of the total system. These additional capabilities will provide necessary automation of many time consuming tasks normally associated with using the finite element methodology.

The postprocessing and material data base modules will be designed, coded and integrated into the staging system. Concurrent with this effort enhancements will be made to the display and edit module and generalized data base. Finally, selected existing analysis codes will be integrated into the staging system to evaluate the system.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0028, APPLICATIONS OF A KINESTHETIC TACTUAL DISPLAY FOR AIRCRAFT CONTROL
R.D. Gilson, Ohio State University, Columbus Campus, School of Engineering, Dept. of Aviation, *190 N. Oval Dr., Columbus, Ohio* 43210 (NSG 1620)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0029, HIGH AOA ANALYSIS OF ADVANCED AERODYNAMIC CONTROL SYSTEM
T.J. Cord, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF141600)

This work unit supports TPO 3, Flight Control, specific goal FG 02B, Flight Control System Design Techniques. The military has been plagued with the problems of aircraft performance and loss-of-control at high-angle-of-attack (AOA) flight conditions, such as those encountered during air-to-air combat. The technical objective is to analyze the control dynamics of fighter-type aircraft at high-AOA to provide the necessary information for revisions to the flying qualities specifications in this area. The information gathered will be used to improve the understanding of the high-AOA phenonmenon and develop improved design guides for high-AOA maneuvering flight.

Analysis of high-angle-of-attack (AOA) aerodynamic data, flight-test time histories, and the flight control system will be conducted to identify factors that limit high-AOA maneuverability. The results will be validated and further investigated by manned simulation at AFFTC.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0030, LAMARS F-106 INTEGRATED FLIGHT/FIRE CONTROL STUDY PROGRAM
R.R. Huber, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF138310)

This program supports the development of advanced integrated flight and fire control (IFFC) concepts for improved air-to-air gunnery in present and future AF fighter aircraft. Current fighter aircraft are severely restricted in the envelope in which present gunsights are effective. This program will develop a director gunsight which expands the effective envelope as well as increasing accuracy for air-to-air gunnery. The objectives of this program are to: (1) develop an in-house capability to perform integrated flight/fire control (IFFC) system analysis using the lamars moving base simulation facility, (2) investigate the interactive dynamics of the sight/man/machine/target in air-to-air gunnery, (3) develop a rational system analysis procedure applicable to future IFFC system analyses and evaluations, (4) develop a director fire control system and (5) investigate improvements to the F-106 stability augmentation system (SAS) to improve the lateral handling qualities for the director flight test program. The identical fire control computer ancillary equipment and algorithms to be used in the flight test will be used in the LAMARS simulation.

Plan and conduct a joint program with AFAL, ADC, ADWC, USAFA and selected contractor support to identify, obtain and integrate hardware and software on the LAMARS simulation facility to simulate the F-106 aircraft and three classes of fire control system sights. Define realistic targets, performance measures, encounter geometries and scenarios. Determine effect upon the performance measures of changes in problem parameters (sight, man, aircraft, target). Obtain and compare flight test data with data obtained in like conditions on the LAMARS simulator.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0031, AUTOMATION AND CONTROL OF WIND TUNNELS
S.R. Palmere, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF141960)

Develop aerodynamic test facilities capable of ground testing weapon systems, high-speed military vehicles and missiles. This work unit will develop facilities, for example, to solve current flight dynamics laboratory, weapons laboratory and SAMSO problems as well as material testing requirements. An increase in the operating parameters of the AFFDL Trisonic Gasdynamic Facility, as well as an increase in the speed of response to changing parameters, is required to enhance the facility's effectiveness in correcting technological deficiencies in the performance of ad-

vanced military vehicle configurations. The objective of the work is to accomplish these goals, both through the automation of the existing equipment and through the overhauling and/or modernization of some of this equipment. It is necessary to improve the gasdynamic simulation capabilities for testing strategic missile nose tips in the AFFDL 50 megawatt ARC facility. A study will be made with the objective to increase the power available for ARC facility testing.

Systems with the electrogasdynamic and trisonic facilities will be automated for more efficient operation and better control repeatability. The needs for additional power in the 50 megawatt hypersonic test leg and rent will be studied with the idea of producing more power from existing equipment as well as increasing the overall capability. The lateral controls for the rent model carriage will be improved to obtain better acceleration, more constant speed and accurate stopping and pinning. These test capabilities will be developed by persons who are electrical specialists in aerodynamic test facilities.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0032, INTEGRATED CONTROL DESIGN TECHNIQUES (PHASE I)

L.S. Gephart, University of Dayton, School of Business Admin., Dept. of Management Science, *300 College Park Ave., Dayton, Ohio* 45469 (DF141490; F33615-77-C-3072)

It is necessary to formulate, demonstrate and validate a total systems approach to provide the managment tools and methodologies for early military aircraft flight control development decisions. The tools exist separately to achieve individual goals for mission performance, reliability, maintainability, redundancy management, safety, and even digital logic for system reconfiguration. The objective of this program is to integrate these tools into a composite design discipline. The end product of this program is a set of management tools and methodologies that can be applied to future integrated control systems purchased by the Air Force.

The program is based on the digital application of system effectiveness modeling with considerations provided to future requirements in the areas of redundancy management, mission safety, and positive alert. Realistic considerations concerning changes in the functional and/or mission requirements relative to the present and future states of the mission will also be evaluated for possible inclusion into the model.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0033, THE LARGE-SCALE STRUCTURE OF TURBULENCE IN A ROTOR WAKE

P.J. Morris, Pennsylvania State University, University Park Campus, School of Science, Dept. of Mathematics, *211 Whitmore Lab., University Park, Pennsylvania* 16802 (NSG 3265)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0034, VTX AIRCRAFT CONCEPTS DEVELOPMENT

L.R. Kravitz, U.S. Dept. of Defense, Navy, Naval Air Development Center, *Warminster, Pennsylvania* 18974 (DN762114)

To develop and analyze aircraft design concept options for a low-operating cost, high-performance, jet trainer aircraft (VTX) for undergraduate pilot training to replace the T-2C and TA-4J aircraft.

Determine and analyze operational, mission and aircraft system performance requirements and goals. Perform VTX aircraft system conceptual design studies. Identify development needs and issues. Develop VTX concept options and prepare development proposal, analyze high-risk areas and develop a plan for resolving issues to meet DSARC I requirements.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0035, STUDY APPLICATION OF WEAR THEORY

M.J. Devine, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN881132)

Provide on-site technology applications for improved wear control/reduction encompassing aircraft hinges, tools, and splines proposed by the 'delamination theory of wear'. This will also include the analysis of laboratory and field results to determine the scope and limits for the application of this theory.

Define and initiate the support programs for specific field tests of aircraft components to further clarify the delamination theory for wear control. In cooperation with Massachusetts Institute of Technology and Foxboro/Trans-Sonics, Inc., review the specific components including design, hardness, and specimen number to be processed for in-service wear studies including inspection intervals, depth of inspection and the appropriate analytical technique including the application of ferrography. Specific areas to be included in the service studies are cutting tools, aircraft splines, and aircraft hinges. The support will provide the utilization of specialized laboratory equipment, e.g., aircraft spline test apparatus and aircraft hinge test. The data base already established for splines, tools, and other components will be made available to determine high failure rate elements and enable the necessary comparison of improvement imparted by new wear technology based on delamination theory.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

1.0036, PRACTICAL METHODS FOR THE COMPENSATION AND CONTROL OF MULTIVARIABLE SYSTEMS

P.L. Falb, Brown University, Graduate School, Dept. of Applied Mathematics, *University Hall, Box 1883, Providence, Rhode Island* 02912 (DF046610; AFOSR-77-3182)

AF function - a study of control methods for high-performance aircraft, helicopters and ballistic missiles. Deficiency - compensation and control of the above systems. Objective - the primary objective of this research effort is the development of practical methods for the compensation and control of multivariable systems. How work contributes - success in this area would facilitate the design of Air Force systems as well as their control systems.

A variety of design procedures have been and will continue to be investigated. The most complex of these is the adaptive controller. It might be explicitly noted that although they require complex and extensive nonlinear elements, adaptive controllers can be used in many instances, when only minimal information regarding the plant is known. If more information regarding the plant is known - e.g., if the dynamical behavior of the plant can be modelled by a linear system with only certain parameters unknown - then it is probably unnecessary to employ a complex adaptive controller to achieve certain design goals, and more simple types of compensation may be employed. These compensators will be an area of research. Finally, if one designs a fixed compensator to control a completely known fixed plant, it is of interest to study how effective such a compensator will be under relatively slight plant parameter perturbations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

1.0037, ADVANCED AIRCRAFT STRUCTURES

Unknown, Telcom Inc., Telcom Systems Incorporation, *2300 S. 9th St., Arlington, Virginia* 22204 (DN790045; N00019-77-C-0376)

Identify the potential significance of advanced structural materials in relation to Navy aircraft system performance requirements and the effectiveness of improved airborne instrumentation and data analysis methods in gaining more economic utilization of Navy aircraft structural life.

Perform engineering study to identify parameters most significantly influencing development and transition into initial use of advanced aircraft construction and improvements to the structural life management process employed for Navy aircraft.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0038, EFFECTS OF ROTOR WAKE ON AERODYNAMIC LOADS OF A HELICOPTER FUSELAGE
C.E. Freeman, U.S. Dept. of Defense, Army, Aviation Research & Development Command, *Fort Eustis, Newport News, Virginia* 23604 (DA0E3556)

The prediction of aerodynamic loads on a helicopter fuselage as a result of the rotor wake is still an uncertain art. These loads contribute significantly to the performance, control, and stability characteristics of helicopters. For the Army helicopter constrained to nap-of-the-earth flight, the problem is especially severe. The objectives of this research are to define the limitations of current analyses and to subsequently develop a unified rotor/airframe aerodynamic analysis. Specifically, experiments will be conducted to define the rotor performance degradation as a function of body geometry and rotor blade loading as a result of fuselage upwash. In addition, rotor wake patterns will be established and fuselage pressure distributions will be obtained to validate potential flow techniques of rotor wake simulation.

The approach used is to obtain measurements of the flow field around generalized helicopter models (1- and 3-meter). Measurement techniques include laser velocimeter (LV) and hot-film measurements of the downwash from a four-bladed rotor and the surface pressure measurements on the bodies. These measurements will be compared with existing rotor wake and body aerodynamics programs. Empirical correction factors will be added to these existing programs to account for the generalized effects of rotor thrust, rotor height above the fuselage, and fuselage width.

SUPPORTED BY U.S. Dept. of Defense, Army, Aviation Research & Development Command

1.0039, HT SS 78-35 - AAH (BELL) CRASHWORTHINESS TESTS
L.T. Burrows, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Applied Technology Lab., *Fort Eustis, Newport News, Virginia* 23604 (DA0E3820)

To determine the degree that industry can design and fabricate an aircraft to the criteria of TR 71-22, i.e., MIL STD 1290.

Crash test the Bell AAH against the criteria of the 95th percentile crash and through extensive instrumentation measure force attenuation to occupants. Program will be initiated in the 4th quarter FY78 after delivery of the aircraft to this laboratory. Following other tests, the aircraft will be drop-tested to destruction.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0040, HT PP 76-12 - INVESTIGATION OF LIFE-PREDICTION TECHNOLOGY FOR SMALL TURBINE ENGINES
Unknown, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Applied Technology Lab., *Fort Eustis, Newport News, Virginia* 23604 (DA0E3833)

To investigate current techniques for determining expected life of small turbine engine components and to identify existing voids in technology which, if filled, could provide the Army and industry with more reliable and effective life-prediction tools. This investigation could result in further work to pursue improved life-prediction techniques and allow better component design capability for particular mission requirements, longer mean-time-between-overhauls with equivalent flight safety, and reduction of total engine hardware required.

Utilizing information from the literature, government and industry, this program will investigate various stress analysis theories (2-D, 3-D) and metal temperature calculation techniques from the standpoint of usability, effectiveness and accessibility of computer codes, stress concentration factors and coating effects, etc., and identify potential improvements which could advance life-prediction technology. The output of this program will include the current status of life prediction relative to Army needs, for future work, where feasible, to fill the voids in technology.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0041, FINITE ELEMENTS FOR STRONGLY NONLINEAR PROBLEMS
R.E. Jones, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF044560; F44620-76-C-0130)

AF function - advanced aerospace vehicles require improved methods of analysis for nonlinear behavior. Deficiency - structural analysis techniques are not available to accurately and efficiently solve nonlinear structural problems. Objective - objective of this research is to investigate improved finite-element techniques for solving nonlinear structural behavior problems. How work contributes - research contributes to development of analysis and design methods in order to achieve higher-performance, more durable flight vehicles.

Research will investigate two recent finite-element formulations. Triangular and quadrilateral plate or double curved elements will be considered which follow minimum potential energy formulations. These elements will be examined in the solution of problems involving large distortions. Accuracy of the elements will be studied by selecting six trial problems. Improvements in element models will also be studied and extensions to composite modeling examined. Finally, the evaluation of the efficiency and accuracy of trial problem solutions will be used to make qualitative recommendations as to when the proposed approach is more advantageous than competing procedures.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

1.0042, INTEGRATED ENGINE EXHAUST NOZZLE
J. Petit, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DN796806; N00140-76-C-1441)

To establish the performance of a 'two-dimensional' integrated engine nozzle reverser and vectoring system for an attack aircraft.

A study will be conducted to determine the thrust minus drag characteristics of the 2-D airframe integrated nozzle (AIN) concept on an F-18 wind-tunnel model. Four advanced nozzle designs will be evaluated on a U.S. Navy-owned, 10% scale, F-18 model. The nozzle types are the F-18 C-D baseline, the Boeing AIN and the GE ADEN and ALBEN systems. The overall program is being jointly funded by the USN-NAPC and NASA, IRC.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center

ASTRONAUTICS

Includes Astronautics (general); Astrodynamics; Ground Support Systems and Facilities (space); Launch Vehicles and Space Vehicles; Space Transportation; Spacecraft Communications; Command and Tracking; Spacecraft Design, Testing, and Performance; Spacecraft Instrumentation; and Spacecraft Propulsion and Power. For Related Information See Also Aeronautics.

2.0001, OPTIMAL ATTITUDE CONTROL OF FLEXIBLE SATELLITES
K.T. Alfriend, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN680434)

The objective of this program is the development of methods for the optimal and sub-optimal attitude control of flexible satellites.

The initial step is the implementation of the satellite flexibility into the control problem. This will be accomplished by investigating the various methods for modeling the flexibility to see how they can be included in the control problem. 5 various classical satellite problems will then be considered to compare methods of minimizing flexible body motion. Finally, general methods will be developed.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, INVESTIGATION OF COMPRESSION FATIGUE PROPERTIES OF ADVANCED COMPOSITES UNDER ADVERSE ENVIRONMENTAL CONDITIONS

G. Grimes, Northrop Corp., Aircraft Division, *3901 W. Broadway, Hawthorne, California* 90250 (DN890107; N00019-77-C-0518)

To determine the fatigue properties of AS/3501-6 composites under compressive loading after exposure to adverse simulated service environments.

Conduct a constant cycle fatigue loading test at r equals plus 10 loading conditions (similar to those occurring in the F-18 upper wing skin). Environmental exposure will consist of 140 degs F, 95% for 40 days. Residual strength and stiffness of unfailed specimens will be determined.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0002, TEMPERATURE-COMPENSATED PIEZOELECTRIC MATERIALS

R.R. Neurgaonkar, Rockwell International Corp., *1049 Camios Dos Rios, Thousand Oaks, California* 91360 (DF052900; F49620-78-C-0093)

AF function - components utilizing advanced SAW technology are needed in AF systems for countermeasures, communications, and signal processing. Deficiency - currently available SAW materials suffer from lack of temperature stability. Severe military applications require high stability and high coupling efficiency. Objective - to produce thin films of ferroelectric materials suitable for SAW applications having high efficiencies and high stability. How work contributes - a successful conclusion to this research will result in the availability of temperature compensated high efficiency SAW substrates.

A theoretical survey of ferroic materials, especially those having the tungsten bronze structure, will be performed. Piezoelectric and elastic properties will be modeled theoretically and suitable materials having high coupling efficiencies and low temperature coefficients of delay will be predicted. These materials will then be grown in thin film form by liquid phase epitaxial techniques. Piezoelectric and elastic properties of these materials will be experimentally measured. Device performance will be evaluated by the construction and characterization of an MSK filter. Theoretical work to be performed at Pennsylvania State University under subcontract.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0003, PVF2 TRANSDUCERS FOR NONDESTRUCTIVE EVALUATION OF CERAMICS AND BRITTLE MATERIALS

H.J. Shaw, Stanford University, W.W. Hansen Lab. for Physics, *Stanford, California* 94305 (DF049450; AFOSR-77-3386)

AF function - ceramic materials are being developed for a variety of components (e.g., blades, vanes, combustors, bearings and seals) in future gas turbine engines and for a variety of electronic and optical components in aircraft. Because ceramics and new brittle metal alloys fail catastrophically from pre-existing flaws or cracks, new nondestructive evaluation, NDE, techniques are required to locate and reject these defects. Opportunity - an important new material, polyvilidene fluoride (PVF2), has been found to have properties particularly suitable for operation as a high frequency ultrasonic transducer. Objective - this research seeks to understand and develop the utilization of PVF2 for application to NDE of ceramics and brittle metals. How work contributes - high frequency, and flexible geometry will allow flaw detection on complex geometries such as turbine blades.

This research will develop the theory, the optimum geometrical configuration and the design curves for PVF2, multilayer transducers. The desired insertion loss, bandwidth and acoustic beam shape will be optimized for the excitation of bulk and surface waves.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0004, SOLID FUEL COMBUSTOR STUDIES

D.W. Netzer, U.S. Dept. of Defense, Navy, Naval Postgraduate School, *Monterey, California* (DN898059)

To develop an interior ballistics model for the solid fuel ramjets.

Adapt the Spalding PISTEP II and CHAMPION computer codes to the solid fuel ramjet configuration and environment. Validate model with existing experimental data.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Weapons Center

3.0005, WEAPONRY - CROSSED MOLECULAR BEAM STUDY OF THE REACTIONS OF OXYGEN AND FLUORINE ATOMS WITH FREE RADICALS AND MOLECULES

Y.T. Lee, University of California, Berkeley Campus, School of Letters & Science, Dept. of Chemistry, *Berkeley, California* 94720 (DN223800; N00014-75-C-0671)

The technical objective of this research is to advance our understanding of the kinetics of chemical reactions relative to combustion and missile plumes. These are of direct relationship to the Navy for advancement of missile and aircraft propulsion, chemical lasers, processes occurring during reentry, and atmospheric reaction of pollutants.

The crossed molecular beam technique will be used to investigate the reactions of oxygen and fluorine atoms. The velocity of the oxygen atoms generated by microwaves or photochemically, will be controlled by the molecular weight of carrier gas and expansion conditions in a nozzle beam. The beam of atoms will react with a crossed beam of selected free radical or molecular species. The products are to be measured by a rotating mass spectrometer detector which scans angular and velocity distribution. A dedicated minicomputer is to be used for on-line data processing.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0006, THE UNDERSTANDING AND EXPLOITATION OF ALLOYS BASED ON (TIAL)

M.J. Blackburn, United Technologies Corp., Research Laboratories, *400 Main St., East Hartford, Connecticut* 06108 (DF680860; F33615-74-C-1140)

To understand and exploit tial intermetallic compounds by investigating phase relationships, alloying behavior and properties of castings.

The research effort will concentrate on two related programs. One effort will focus on the development of crucible and mold materials suitable for TiAl with the objective of growing single crystals or other directionally solidified structures. The second parallel effort will investigate the alloy behavior of the compound TiAl to provide information on crystal chemistry and the influence of chemistry and structures on mechanical properties with emphasis on high-temperature creep and low-temperature ductility.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Materials Lab.

3.0007, ANALYSIS AND DESIGN OF BONDED JOINTS IN STRUCTURES OF COMPOSITE MATERIALS IN A HYGROTHERMAL ENVIRONMENT

J.R. Vinson, University of Delaware, School of Engineering, Dept. of Mechanical & Aerospace Engineering, *Newark, Delaware* 19711 (DN875275; N00014-78-C-0199)

Improvements in methods of analyzing and designing bonded structural joints of composite materials is the primary objective of this effort. Such improvements would be extremely valuable for various naval vehicles especially missile and aircraft structures.

An improved mode to analyze bonds in composite structures accounting for hygrothermal effects (i.e., thermal and humidity) will be utilized to assess the stress field in these joints. A number of generic structures using this improved model will be analyzed and correlations made with experimental results. Example joint classes include the following: double lap, single doubler, stepped lap, tapered lap, scarf, repair patch.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0008, EVALUATION OF CHEMICAL RESEARCH RELEVANT TO CURRENT AND PROJECTED U.S. AIR FORCE INTERESTS

J.E. Earley, Georgetown University, School of Arts & Sciences, Dept. of Chemistry, *3800 Reservoir Rd. N.W., Washington, District of Columbia* 20007 (DF039870; F44620-75-C-0001)

AF function - flight operations, communications, and logistics rely on superiority in the materials, propulsion, and avionics technologies. Deficiency - advances in the technologies need long lead time discoveries in scientific chemical research. Objective - this effort provides in-depth expert scientific evaluation of proposed research programs in the field of chemistry. How work contributes - the results of the evaluations contribute to the selection of chemical proposals of the highest scientific merit. This, coupled with the scientific and relevance assessments made by AFOSR scientists, makes up the highly competitive and balanced selection procedure.

This effort provides the means for in-depth scientific evaluation of chemical research proposals by leading scientists in the nation. The panel is made up of fourteen experts from the academic, industrial, and governmental chemical science communities. Activities typically include two meetings of the panel each year, the in-depth review of selected research proposals, and other expert consultation, as requested. The determination of Air Force relevance, the in-house scientific review, along with the in-depth scientific review by the evaluation panel, insures the selection of high-quality research for inclusion in the AFOSR, Directorate of Chemical Sciences' program.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0009, CRACK PROPAGATION IN AIRCRAFT STEELS

J.M. Krafft, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN480036)

This project will develop and define a comprehensive test methodology for assessing the susceptibility of high-strength materials to corrosion initiated and catalyzed failures.

Both static and cyclic loading spectrums will be employed to study crack initiation from the pre-existing notch in a compact tension specimen. The combined effects of various aggressive environments and loading conditions will be examined.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0010, NAVY VEH & MAT SUPP TECH STUDIES TO IDENTIFY AND IMPROVE RESISTANCE TO LOW AMPLITUDE HIGH MEAN STRESS FATIGUE OF TI ALLOY

D.A. Meyn, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN880065)

To determine factors causing or abetting failure of titanium alloy aircraft components by LAHMS fatigue, identify principles for improving resistance to failure including surface treatment, composition, and heat treatment.

Conduct fatigue tests under simulated service conditions on non-precracked specimens, evaluating effects of external factors such as load history, surface coatings, environment, shot peening, and fretting. Test a variety of alloys and heat treatments. Examine crack initiation and propagation mechanisms using metallography, fractography, and surface chemical analysis. Correlate results to show trends toward best performance, and produce systematic identification criteria for failure analysis.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0011, SINGLE-CRYSTAL SUPERALLOYS FOR TURBINE BLADES

D.N. Duhl, United Technologies Corp., Pratt & Whitney Aircraft Group, *P.O. Box 2691, West Palm Beach, Florida* 33402 (DN890005; N00019-77-C-0512)

To develop single-crystal nickel-base superalloys as single crystals for high-temperature aircraft gas turbine blading.

Alloys based on the composition Ni-5Al-2Ti-12W-1Cb-9Cr will be developed in single-crystal form. Variations of refractory metals, titanium, and aluminum will be studied. Mechanical properties and oxidation-sulfidation resistance of optimum alloys will be determined at temperatures to 2000 F.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Sea Systems Command

3.0012, NAVY VEHICLE DESIGN AND CONSTRUCTION - DEFORMATION AND FATIGUE IN BETA TITANIUM ALLOYS

E.A. Starke, Georgia Inst. of Technology, School of Chemical Engineering, *225 North Ave. N.W., Atlanta, Georgia* 30332 (DN123525; N00014-75-C-0349)

Titanium alloys are used in aircraft because of their many desirable properties--lightweight, good strength, ductility, and corrosion resistance. This project will develop needed information on the mechanical properties of beta titanium alloys that show promise of excellent formability and toughness.

A series of low cycle fatigue tests will be conducted to determined the cyclic stress-strain response of four Ti-V alloys heat-treated to produce various microstructures having different deformation modes. The effects of microstructure on the crack propagation rate, fracture path and fracture mode will be found. High strain followed by low strain cycling will be employed to measure the effects of variable strain loading. Some stress controlled tests will be run to see if specimens that cyclic harden are resistant to this type of fatigue situation.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0013, ATOMIZATION OF BROAD-SPECIFICATION AIRCRAFT FUELS

J.G. Shifstad, Purdue University, Graduate School, *Executive Bldg., West Lafayette, Indiana* 47907 (NSG 3258)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0014, TERATOGENIC POTENTIAL OF COMMERCIAL JET FUEL A

R.P. Beliles, Litton Bionetics Inc., *5516 Nicholson Ln., Kensington, Maryland* 20795 (PS-15-LBI(302))

Separate groups of pregnant Charles River Sprague-Dawley derived COBS rats are being exposed by inhalation to a reference sample of Commerical Jet Fuel A at 100 ppm and 400 ppm from 6 through 15 days of gestation. Sham control rats are used. Dams will be sacrificied prior to parturition and fetuses will be examined for potential teratogenic effects of the fuel.

SUPPORTED BY American Petroleum Inst.

3.0015, IMPROVED REACTION SINTERED CERAMICS FOR ENGINES

D.R. Messier, U.S. Dept. of Defense, Army, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center, *Watertown, Massachusetts* 02172 (DA0G4699)

The use of ceramic components in engines inevitably involves comprimises between factors such as ease of fabrication and low cost vs. optimum corrosion, erosion, mechanical and thermal properties. The objective of this program is to develop improved, economical ceramic materials for future Army power generation and propulsion applications. Although this work is specifically related to the use of ceramic components in the MERADCOM 10 kw turboalternator, it also relates to pacing materials problems in aircraft (Turbine Components - 14.2, 15.2, 15.7, 15.11 in FY76 guidance), armored vehicles (combustor, power turbine, and regeneration for 1370 degrees C TIT), and problems in surface mobility and craft and missile materials. The major thrust is cost reduction via fuel economy.

Although reaction sintered silicon nitride is attractive as an inexpensive, fabricable material for use in the nozzle and combustion chamber sections of the 10 kw turboalternator, its resistance to erosion and oxidation appears marginal for such use. A

coating technique that was investigated in a preliminary manner in a previous investigation appears promising for overcoming these deficiencies. It has been shown that precoating porous silicon nitride with titanium enhances its wetting by silicon at elevated temperatures (ca. 1430 degrees C) providing a means of obtaining impervious coatings of silicon on silicon nitride. The coatings may be used as is, or nitrided to form dense silicon nitride coatings. The coating process will be optimized, coating properties will be characterized, and, subsequently, vanes will be coated for testing in the MERADCOM 10 kw turboalternator. Other materials or coating processes may also be considered.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center

3.0016, NAVY VEHICLE DESIGN AND CONSTRUCTION-STRENGTHENING MECHANISMS IN BETA TITANIUM ALLOYS

D.A. Koss, Michigan Technological University, School of Engineering, Dept. of Metallurgical Engineering, *Houghton, Michigan* 49931 (DN223465; N00014-76-C-0037)

The high strength-to-weight ratio and corrosion resistance of titanium alloys make them highly desirable for use in aircraft and submarine structures. This research effort will examine ways to increase the strength and toughness of titanium alloys.

Fast fracture will be examined in Widmanstatten colonies of alpha-beta Ti-8Al-1Mo-1V. Dependence of fracture toughness and crack path will be found as a function of alpha and beta phase orientation to the stress axis. Crack growth will be determined as a function of crystallographic orientation in alpha Ti-6Al single crystals in the absence or presence of hydrogen, thereby seeing the degree to which hydrogen assists crack advance. The relationship between shear strain and normal stresses will be examined in alloys exhibiting fracture by inhomogeneous slip.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0017, FEASIBILITY OF DIESEL FUEL MARINE AS AN EMERGENCY AIRCRAFT FUEL

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To determine the suitability or adaptability of diesel fuel marine (DFM) or mixtures of DFM and JP-5 for emergency use in gas turbine engine powered aircraft during shortages of JP-5. This is a continuation of work formerly done under work unit DN789752 which has been terminated.

Evaluate DFM and blends with JP-5 by standard JP-5 specification tests. Determine combustion performance and performance of aircraft fuel pumping and metering equipment. Evaluate compatibility with aircraft materials and with fuel decontamination equipment. Determine limitations on use of DFM. Some of this work is being performed on contract in work unit DN789777.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Material Command

3.0018, SUPERCONDUCTIVITY IN NONSTOICHIOMETRIC COMPOUNDS, LAYERS AND CHALCOGEN TERNARIES

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AF function - high-temperature superconducting materials are needed for application in airborne multimegawatt power generation and conditioning systems. Opportunity - research specifically directed toward the synthesis and characterization of high transition temperature metallic compounds can provide a greater margin of design efficiency and operational reliability than presently available superconductors. Objective - the aim of this research is to determine the effect of chemical composition on superconducting properties. Progressive cation-for-cation and anion-for-anion substitution as well as departure from stoichiometry are exploited in an attempt to fine-tune the parameters that control superconductivity. Results should be useful in providing a quantitative chemical rationale for improving the critical properties of presently known superconductors and for discovering new ones. How work contributes - the use of superconductors in airborne multimegawatt power generation and conditioning systems is desirable because of their ability to carry much larger current densities than conventional conductors and with much lower losses. Hence very high magnetic fields can be generated with smaller, lighter windings. For many potential applications, the performance of high field magnets and solenoids, electric motor windings, superconducting rotors in power generators, transformers and induction energy storage systems could be significantly improved if the upper critical field, the current carrying capacity and the critical transition temperature of the superconducting materials could be enhanced.

Four kinds of compounds are being studied - (a) layered dichalcogenides, (b) metal-molybdenum-chalcogen ternaries, (c) tungsten bronzes, and (d) covalent-frame metal hexaborides. Direct, high-temperature synthesis from ultra-pure starting elements, electrochemical reduction, and high-frequency induced boron flash reduction are used to prepare the materials. Chemical and structural characterization is by x-ray, electron microscope, neutron activation, and ion microprobe analysis. Single-crystal conductivity, hall voltage, and thermopower are measured by multi-probe AC and DC techniques over the range from 4.2 to 300 K. Powder magnetic susceptibilities by the Faraday method and ESR absorption at X band are measured over the same range. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0019, ULTRASONIC NONDESTRUCTIVE TESTING OF COMPOSITE MATERIALS

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AF function - advanced composite material systems can significantly improve the performance of advanced flight vehicles. Deficiency -nondestructive inspection techniques are not available to insure initial material quality or its service life damage tolerance. Objective - to develop quantitative ultrasonic NDI techniques for advanced composites which considers the dispersive and dissipative nature of the material. How work contributes - result will contribute to the logistic inspection capability of composite structural applications.

Both theoretical and experimental investigations of the propagation and scattering of ultrasonic waves in various composite materials will be undertaken. The work will begin with unflawed materials and be expanded to materials with prefabricated and controlled flaws. The propagation characteristics of continuous waves and pulses, including their dispersion and dissipation, will be analyzed and measured in composite material specimens. Main effort of research is directed at the investigations of the dissipation of energy of waves in composite materials through the multiple scattering by fibers, the multiple scattering by voids and micro cracks in the matrix, and the viscosity in the matrix material.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0020, PHYSICS AND CHEMISTRY OF MATERIALS

J.A. Bruce, U.S. Dept. of Defense, Air Force, Rome Air Development Center, *Griffiss Air Force Base, Rome, New York* 13441 (DF902900)

AF function - development and improvement of electromagnetic materials and components used in C3 applications. Deficiency - need to characterize the structure and properties of EM materials and components to aid their development and improvement. Objective - to study the chemistry and physics of bulk and thin film materials, surfaces and device structures. How research contributes - this work is in direct support of both materials and device programs of this laboratory.

Defect properties such as dislocations of stacking faults, microtwins, impurities, etc., of components, device structures and their associated materials will be examined by x-ray topography and transmission electron microscopy. Scanning electron microscopy, optical microscopy and auger spectroscopy techniques will be combined for both chemical and topological analysis of surfaces. Structured and chemical composition will be determined by both x-ray and electron diffraction.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

3.0021, STUDIES OF SILICON-NITROGEN-PHOSPHORUS(V) COMPOUNDS INCLUDING A NEW SYNTHESIS OF PHOSPHAZENES 15108-C

R.H. Neilson, Duke University, Trinity College of Arts & Sciences, Dept. of Chemistry, *Durham, North Carolina* 27706 (DA0F9088; DAAG29-77-G-0214)

An exploratory study of phosphorus (V) compounds including a new synthesis of phosphazenes will be undertaken. Relevance - this research has the potential to lead to a new synthesis of phosphazenes which is less costly and results in material of higher purity than the currently available method. Phosphazenes have many outstanding properties currently being exploited extensively for numerous Army applications (helicopter seals, low-temperature fuel hoses, flame-proof materials, etc.).

Pentacoordinate silicon-nitrogen-phosphorus compounds will be synthesized and characterized. The thermal decomposition of these compounds leading to a new, general synthesis of phosphazenes will be explored.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0022, EFFECTS OF MOISTURE AND TEMPERATURE ON POLYMER-MATRIX COMPOSITES 15183-MS

J.C. Hurt, University of North Carolina, North Carolina State University, School of Engineering, Dept. of Materials Engineering, *Raleigh, North Carolina* 27607 (DA0F8987; DAAG29 77 G0124)

To study the mechanisms of degradation of polymer-based fiber-reinforced composites in the presence of moisture and moderately high temperatures. Relevance - this research is relevant to the performance of polymer matrix composites for applications such as helicopter components (e.g., rotor blades and fuselage panels), personnel armor, tank wheels, missile motor cases, rocket launch tubes, and electronic circuit boards. The environmental degradation of polymer matrix composites has been referred to as the Army's number one problem in the area of composites.

The study will include: (1) Experimental determination of the temperature- and moisture-dependent mechanical properties of the constituent polymers and fibers, as well as the composites. (2) Determination of the absorption and diffusion coefficients for moisture in the constituent resin and fibers. (3) Determination of the mechanisms of interaction of the moisture with the composite. (4) Development of a micromechanical model to describe the elastic and elastic-plastic behavior of the composite.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0023, EFFECTS OF HOT-FORGING VARIABLES UPON MICROSTRUCTURE AND PROPERTIES OF METALS AND ALLOYS

T. Altan, Battelle Memorial Inst., *505 King Ave., Columbus, Ohio* 43201 (DF043000; AFOSR-76-2971)

AF function - Air Force applications of metals and alloys generally require some metalworking operation to bring parts to final shape before assembly. Forging of materials is a very common means of producing sound parts having uniform composition, microstructure, and properties for use as engine discs, blades, and vanes, and also in non-engine components such as structural airframe parts. Opportunity - a knowledge of forging variables has far-reaching consequences, including considerable production cost savings and optimum mechanical properties in the final part. Objective - this research will develop a fundamental understanding of the behavior of metals which are subjected to complex strain/strain rate/time/temperature histories, and how this behavior affects the hot-forging response of the material. How work contributes - the understanding of forging fundamentals can best be accomplished through an approach incorporating a cooperative interaction between materials scientists actively engaged in the field of high-temperature deformation and fracture, and mechanists skilled and experienced in analyzing metal flow during complex processing operations.

This research will involve determining quantitative relations between hot-forging process variables such as working loads, strain rates, and temperature, and the material response in terms of flow, fracture, microstructure and mechanical properties. The research will be performed on pure aluminum and nickel, and alloys of aluminum and nickel.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0024, MOLECULAR MECHANISM OF THERMAL DEGRADATION OF POLYIMIDE RESINS

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0025, THREE-DIMENSIONAL BISPECTRA AND THE MEAN RATE OF TRANSFER OF ENERGY IN TURBULENCE

J.L. Koenig, Case Western Reserve University, School of Engineering, Dept. of Macromolecular Science, *University Cir., Cleveland, Ohio* 44106 (NSG 3276)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0026, CHEMICALLY MODIFIED ELECTRODES

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0027, A MECHANISTIC EVALUATION OF DEFORMATION AND FRACTURE IN HIGH-TEMPERATURE LOW-CYCLE FATIGUE

S.D. Antolovich, University of Cincinnati, School of Engineering, Dept. of Metallurgical Engineering & Materials, *101 Baldwin Hall, Cincinnati, Ohio* 45221 (NSG 3263)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0028, THE ROLE OF HYDROGEN IN THE STRESS CORROSION CRACKING OF HIGH-STRENGTH ALUMINUM ALLOYS

L.M. Bernstein, Carnegie Mellon University, Inst. of Technology, Dept. of Metallurgical & Materials Sci, *Frew Ave. & Margaret Morrison, Pittsburgh, Pennsylvania* 15213 (DF046820; F49620-77-C-0003)

AF function - hydrogen embrittlement is a serious problem that causes mechanical property degradation in our most significant aircraft materials including steels, titanium, aluminum and nickel-base alloys. Opportunity - hydrogen-related phenomena are suspect of playing key roles in the mechanisms of stress corrosion cracking, subcritical crack growth, hot salt corrosion, weld cracking, temper embrittlement, fatigue crack growth, and brittle fracture in general. Objective - this investigation will identify the role played by hydrogen in stress corrosion cracking of high-strength aluminum alloys through determination of microstructural and fractographic correlations with cracking, direct observations of cracking, permeation studies, and mechanical tests

under cathodic charging conditions. How work contributes - the various forms of hydrogen-related mechanical property degradation severely restrict the serviceability of our important aircraft materials. Basic understanding of the manner by which hydrogen acts to reduce mechanical strength and cause failures is important if we are to minimize and control these forms of attack.

Specific emphasis will be placed on the role of metallurgical variables such as precipitate type, size and distribution, to develop these as control variables for the production of high-strength aluminum alloys (7000-series) more resistant to hydrogen embrittlement and/or stress corrosion cracking.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0029, NUCLEAR MAGNETIC RESONANCE AND ACOUSTIC NUCLEAR RESONANCE FOR NONDESTRUCTIVE EVALUATION OF STRUCTURAL MATERIALS

G.A. Matzkanin, Southwest Research Inst., *8500 Culebra Rd., San Antonio, Texas* 78228 (DF044200; F44620-76-C-0114)

AF function - the nondestructive evaluation (NDE) of aircraft structural materials plays an important role in safety and cost-effective use of the fleet. Deficiency - there is a deficiency in techniques for determining the residual stress and strains introduced into materials during fabrication or subsequent use. Such stresses play important roles in fatigue damage processes, stress corrosion cracking, and hydrogen embrittlement. Objective - this research seeks to apply nuclear magnetic resonance (NMR) and acoustic nuclear resonance (ANR) techniques to NDE problems of practical interest to the Air Force. How work contributes - the specific features of NMR and ANR will be defined and developed for the quantitative characterization of internal strain and stress in nonferromagnetic structural materials, such as Al, Ti, composites, and nonmetallics.

Inductive NMR signals will be detected from specimens external to both the detecting coil and the magnetic gap by utilizing a pancake-shaped detection coil placed near the surface of the specimen, with the applied field produced by U-shaped magnets. Continuous and pulsed ANR techniques will be developed for polycrystalline materials.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0030, THE EFFECT OF AN IMPRESSED ELECTRIC FIELD ON THE METALWORKING OF AIRCRAFT STRUCTURAL MATERIALS

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AF function - Russian scientists have recently reported that plastic deformation of aerospace metals is strongly influenced by impressed electric fields and currents. This research offers a fundamental study of this phenomenological event so that aerospace vehicles, propulsion systems and structural materials might thereby be improved. Opportunity - a scientific explanation of the Russian breakthroughs in this area does not now exist. The opportunity and needs for this research is critical for the national engineering community and results are urgently required. Objective - the objective of this work is to properly characterize the effect of an impressed voltage on an aeronautical aluminum alloy. The phenomenalistic events are to be interpreted for extension to real systems involving deformation mechanics. How work contributes - part of the AFOSR mission is to provide a scientific understanding for complex engineering or technological problems. This research will serve the interests of the USAF by giving solutions to foreign technology problems which are not yet understood.

As a first step to assessing the application of this so-called electroplastic effect to practical problems, the simple expedient of rolling an aluminum alloy while an electric current is being applied is suggested. The rolling load will be monitored and the percent ductility determined and compared to the corresponding values in the absence of an electric current. The resulting mechanical properties and microstructure will also be determined to assess the effect on these parameters. Analytically, the program will interpret the data and results in terms of mechanical metallurgy so that improved metalworking methods for solid mechanics might thereby be improved.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0031, EXPERIMENTAL AND ANALYTICAL STUDY OF EROSIVE BURNING OF SOLID PROPELLANTS

M.K. King, Atlantic Research Corp., *5390 Cherokee Ave., Alexandria, Virginia* 22314 (DF042250; F49620-78-C-0016)

AF function - future rocket weapons systems will employ low port-to-throat area ratio designs and as such will be subject to considerable erosive burning phenomena. Deficiency - rocket designers are currently unable to accurately predict erosive burning rates. Objective - this effort will develop and verify an accurate method of predicting propellant burn rates in erosive environments. How work contributes -this work is virtually the entire U.S. effort aimed at in-depth understanding of the erosive burning phenomenon in solid-propellant rockets.

This work unit consists of a prime contract and two sub-contracts, and is the entire Air Force research program aimed at understanding and predicting erosive burning. To a large extent, the content of the research is a continuation of that previously carried out under F44620-76-C-0023, F44620-76-C-0016 and AFOSR-76-2914, at Atlantic Research Corporation, Aeronautical Research Associates of Princeton, and the Pennsylvania State University, respectively. Experimental measurements of erosive burning rates with two different kinds of test rigs are being made on selected and standardized propellant formulations. These test results, obtained as functions of pressure, temperature, cross-flow velocity, turbulence, particle-size and propellant type, will be used to evaluate the somewhat different models being derived, extended, refined and programmed at all three locations. Early versions of ARC's flame-bending model, ARAP's solid-propellant erosive combustion (SPEC) model, and the Penn State reacting turbulent boundary layer model have all been published. As work on improving these models intensifies under this contract, they are coming closer together and should eventually yield the one most useful predictive scheme for erosive burning.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0032, USE OF TWO-DIMENSIONAL TRANSMISSION PHOTOELASTIC MODELS TO STUDY THE STRESS IN DOUBLE LAP BOLTED JOINTS

M.W. Hyer, Virginia Polytechnic Inst. & State University, Graduate School, *Blacksburg, Virginia* 24061 (NSG 1621)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

3.0033, INVESTIGATION OF REINFORCED THERMOPLASTIC COMPOSITES

J.T. Hoggatt, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DN890066; N00019-77-C-0561)

To evaluate fiber-reinforced thermoplastics for aircraft structural applications.

Develop methods for the impregnation and fabrication of improved thermoplastic materials to overcome deficiencies in solvent resistance and thermal stability. Investigate metal-clad thermoplastics for suitability as construction materials.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, TERMINAL GUIDANCE TECHNOLOGY - GUIDANCE SYSTEM, INTEGRATION AND VERIFICATION
J.P. Leonard, U.S. Dept. of Defense, Army, Missile Research & Development Command, Technology Lab., *Redstone Arsenal, Huntsville, Alabama* 35809 (DA0F1029)

To establish a validated technology data base on advanced terminal guidance techniques.

To evaluate and establish performance capabilities and limitations of advanced terminal homing guidance techniques and their hardware implementations by developing six degree of freedom digital simulations, continually validating these simulations by utilizing available field target scene measurements data and performance data from breadboard prototype hardware components, utilizing these simulations to generate hardware specifications for procurement, developing hardware-in-the-loop simulations, conducting laboratory, captive and missile flight-tests of prototype flightworthy hardware.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Advanced Sensors Directorate

4.0002, OBSERVATIONS OF 'FIREWHEEL' CHEMICAL RELEASES
T.J. Hallinan, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (NSG 6028)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Wallops Flight Center

4.0003, INVESTIGATION OF ELECTROCHROMIC DIPHTHALOCYANINES
M.M. Nicholson, Rockwell International Corp., *3370 Miraloma Ave., Anaheim, California* 92803 (DF048120; F49620-77-C-0074)

AF function - future Air Force operations require improved electrooptical and electronic materials for use in flight control, reconnaissance and surveillance, and signal processing and control devices. Deficiency - a need exists for new materials which can be exploited for the design of new concepts and classes of electrooptical devices. Objective - the objective is to determine mechanisms and rate parameters for electrochromic transformations in rare-earth diphthalocyanine complexes. How work contributes - the research will provide a new class of electrooptical materials which may find applications in visual displays, large-array memories, and other electronic devices.

The mechanisms and rate parameters for electrochromic transformations in rare-earth diphthalocyanines will be determined. The kinetics of the electrode processes will be determined from electrical and optical transient responses. The methods of investigation will include in situ spectroelectrochemical measurements, thin-layer electrochemistry, and charge-carrier injection techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0004, CAPLESS ANNEALING OF ION IMPLANTED GAAS
A.A. Immorlica, Rockwell International Corp., *1049 Camios Dos Rios, Thousand Oaks, California* 91360 (DF053400; F49620-78-C-0111)

AF function - microwave solid-state electronic devices are essential components of Air Force reconnaissance, electronic countermeasures and communications systems. Opportunities - the development of ion implanted microwave GaAs devices envisioned for use in Air Force avionics systems is somehat limited by the availability of suitable encapsulation layers needed for post-implantation annealing of ion implanted GaAs. Although a variety of capping techniques have been investigated in a number of laboratories, problems of reproducibility and stability at higher anneal temperatures have deterred the routine production of ion implanted device structures. At present the successful application of the implantation technique to the fabrication of GaAs devices is strongly dependent upon reproducibility of a suitable capping material. Objective - the objective of this research is to develop a new annealing technique which does not require an annealing cap thus eliminating many problems resulting from cap-substrate interactions during the anneal. How work contributes - the outcome of the research would greatly simplify the preparation of implanted GaAs active layers and would be applicable to the fabrication of planar devices and integrated circuits for annealing of selective area implants.

The approach taken will be to conduct a fundamental study of the capless annealing technique and apply the PAT process to the activation of dopant ion profiles. The results will be compared with those obtained using conventional annealing technologies using fundamental measurements as well as FETs as a device test vehicle. Fundamental doping phenomena, particularly the effects of strain will be observed in order to model and compare the two technologies to determine situations in which they may be most advantageously employed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0005, PRODUCTIVE USES OF AEROELASTICITY RESULTING FROM UNSTEADY FLOW PHENOMENA
A. Holt, Stanford University, Graduate School, *Stanford, California* 94305 (DF140160; AFOSR-77-3263)

This work unit supports the evaluation of the aeroelastic response of aircraft structural components. It will contribute to the development of improved unsteady aerodynamic methods to predict aircraft aeroelastic stability and structural dynamic response. The goal is to conduct theoretical studies and unsteady aerodynamic tests for oscillating airfoils in subsonic wind tunnels, resulting in ultimate savings in design and cost of new aircraft and improved performance. The orderly development of analytical methods coupled with the capability to make experimental measurements of cyclic airfoil motion will contribute to the design of aircraft for minimum weight and cost.

The proposed effort will include a theoretical investigation of the response of airfoils under cyclic motion, assembly and development of methods for evaluating the aeroelastic properties of composite configurations, of unsteady aerodynamic phenomena associated with flight propulsion, and experimental measurement of chordwise aerodynamic forces during flapping and pitching motion. The objective is to measure and categorize the phenomena associated with oscillating airfoils in an attempt to identify an aerodynamic cycle that results in net lift and thrust.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0006, THE EXPERIMENTAL AND ANALYTICAL DEVELOPMENT OF SENSITIVE SUPERCONDUCTING ACCELEROMETER AND GRAVITY GRADIOMETER
W.M. Fairbank, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (DF041930; AFOSR-76-2913)

AF function - gravity gradiometer is required to determine the deflection of the vertical along flight path to improve the missile CEP. Deficiency - gravity gradiometers are required to operate with an accuracy of ten to the minus 12 g/m. This is so demanding that closed loop mode operation will be essential. Although present technology of electronic components has reduced the thermal noise levels within the system to their equivalent Brownian motion, cryogenic techniques will be required to make any significant reduction in the respective noise levels. Objective - the properties of the accelerometer and gradiometer to be investigated indicate an exciting potential in applications which are presently difficult and beyond the state-of-the-art of existing techniques. The extremely low threshold suggests measuring the gradient in the gravitational field without excessive averaging times. Contribution - inertial navigators are ultimately limited in accuracy by their knowledge of the local gravity field, in particular the tilt of local vertical. Therefore, improved gravity gradiometer will provide the necessary data to determine the deflection of vertical during the flight path or operation.

It is proposed that instrument design limitations and ultimate threshold sensitivity be investigated and experimentally verified.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0007, IMPLANTATION AND DIFFUSION OF IMPURITIES IN COMPOUND SEMICONDUCTORS WITH APPLICATION TO THE FABRICATION OF MICROWAVE DEVICES 15605-EL

J.F. Gibbons, Stanford University, School of Engineering, Dept. of Electrical Engin, *Stanford, California* 94305 (DA0F9256; DAAG29-78-G-0119)

To establish physical mechanisms that are responsible for annealing and diffusion of implanted dopants in compound semiconductors, and to develop a mathematical model which will predict the implanted impurity profile after annealing from the established implantation conditions. Relevance - ion implantation is being adopted as a basic processing technique for many new high-frequency discrete devices and high-speed integrated circuits. The understanding of the ion implantation process will be a necessary prerequisite to the development of a compound semiconductor device technology.

A rapidly emerging technique, that of laser-annealing of the implanted layer, will receive considerable attention as applied to both GaAs and InP. Here the emphasis will be directed towards establishing the proper condictions for laser-annealing, as well as understanding the physical mechanisms responsible for the electrical activation of the implanted species. Further work will also be carried out in the study of basic diffusion mechanisms occurring when GaAs and InP are annealed at high temperatures with a passivating layer.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0008, COMPUTING METHODS FOR THE APPROXIMATE SOLUTION OF TIME-DEPENDENT PROBLEMS

J.E. Oliger, Stanford University, School of Humanities & Sciences, Dept. of Computer Sci, *Stanford, California* 94305 (DN575403; N00014-75-C-1132)

Time-dependent boundary value problems in fluid mechanics are, as a class, the most difficult problems in computational mechanics. It is often not clear how to properly formulate the mathematical form the problem, theory is not yet an adequate guide to choosing well-behaved solution procedures (algorithms), and often either inadequate or inaccurate data must be used to drive the chosen algorithm. These problems are particularly acute in geophysical fluid mechanics, a subject area of increasing interest to the Navy because of increasing dependence on numerical weather forecasts and numerical models of oceanographic phenomena. Often, understanding of oceanographic phenomena is only available through numerical models.

This research will extend the so-called Kreiss-Oliger stability theory to larger classes of problems. It will also investigate the numerical 'well-posedness' of problems in geophysical fluid mechanics and attempt to find well posed formulations which use the types of data which are available from modern sensors, e.g., those used on observational satellites.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0009, STUDY THE CONTROL OF PC 3,4 MICROPULSATIONS BY INTERPLANETARY MAGNETIC FIELD ORIENTATION AND OTHER WIND PARAMETERS

E.W. Greenstadt, Thompson Ramo Wooldridge Inc., *1 Space Park, Redondo Beach, California* 90278 (DF046410; F49620-77-C-0018)

AF function - communication and surveillance systems depend on conditions in the near-earth space environment. This research seeks to specify and predict disturbances in the solar wind and the magnetosphere using ground-based measurements of magnetic pulsations, which are easy and economical to make compared to satellite measurements. Deficiency -improvements are needed in quantifying the existing correlation between micropulsations observed on the earth's surface and solar wind properties and in understanding the whole solar wind to surface process of energy transfer. Objective - to use geomagnetic pulsation records acquired at the earth's surface to infer parameters of the solar wind, such as velocity and magnetic field magnitude and direction, and of the magnetosphere, such as magnetopause distance and subauroral plasma density. Contribution - theory and techniques will lead to a routine use of micropulsation data to generate magnetospheric and exomagnetopheric diagnostics.

A joint distribution of pulsation amplitude as a function of interplanetary magnetic field angle and solar wind velocity will be defined using the Calgary Observatory and Explorer 35 satellite data for the fall of 1969. New intervals will be established when angle, speed and pulsation data are available at several stations along a meridian. Direct satellite evidence will be sought to verify the theoretical model of the transfer of perturbation energy from the magnetospheric bow shock to the earth's surface. A means of normalizing pulsation measurements with respect to its period in the naturally decreasing micropulsation spectrum will be studied. The use of AFGL stations as the data source of an operational micropulsation system for space diagnostics will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0010, AERONAUTICAL TECHNOLOGY, TECH AREA XI(M) - MAN-MACHINE INTEGRATION

I.C. Statler, U.S. National Aeronautics & Space Admin., Office of Aeronautics & Space Technology, Ames Research Center, *Moffett Field, California* 94035 (DA0E3520)

To develop and maintain a technology base in man-machine integration (MMI) principles and pilot performance and workload measurement that will maximally support the mission of the aeromechanics laboratory and AVRADCOM in improving Army air mobility vehicles and systems.

The approach will involve use of laboratory, simulation and occasionally flight tests, supplemented as appropriate by human factors systems analyses and mathematical modeling. Tests will initially focus on specific elemental building blocks or aspects, followed by combinations of these in integrated system concepts and measurement packages.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Aeromechanics Lab.

4.0011, MECHANISMS OF EXHAUST POLLUTANT AND PLUME FORMATION IN CONTINUOUS COMBUSTION

G.S. Samuelsen, University of California, Irvine Campus, School of Engineering, Dept. of Mech & Environmental Engin, *Irvine, California* 92664 (DF052000; AFOSR-78-3586)

AF function - weapon delivery and defense, advanced air-breathing engines. Deficiency - insufficient understanding of relative influence of physical and chemical processes involved in high-speed turbulent reacting flows, lack of realistic guidelines for predicting exhaust gas pollutant and plume formation, and lack of realistic guidelines for measurement of nitrogen oxides. Objective - to clarify the relative influence and to formulate realistic analytical representation of the mechanisms and processes responsible for pollutant production and plume formation in jet engine continuous combustors and improved measurement methods for nitrogen oxides. How work contributes - will provide additional understanding and realistic modeling of turbulent reactive flow fields not now available, contribute to establishing guidelines and techniques for reducing adverse environmental effects and controlling plume signatures in jet engine combustors by control and modification of combustion dynamic processes and contribute to establishing guidelines for the measurement of nitrogen oxides.

Studies of mechanisms responsible for pollutant and plume formation in jet engine continuous combustors will be carried out. Experiments will be conducted with both nonreacting and reacting flows in a premixed opposed jet combustor (OJC) and non-premixed combustor (NPMC) under conditions simulating basic flow characteristics of gas turbine engines. Theoretically predicted profiles of flow properties will be compared with experimentally determined profiles to evaluate numerical techniques used to solve governing differential equations describing the OJC and associated models of turbulence for nonreacting flows and coupled models will be identified and used to formulate refined methods for accurately predicting formation of combustion-generated pollutants. Parametric studies will be conducted to identify the relative contribution of transport mechanisms, chemical kinetics and system parameters to pollutant formation. Par-

ticulate formation and luminosity related to alternate fuels will be studied. The potential of utilizing the OJC in real gas turbine combustor applications (e.g., fuel injection, flame stabilization) to reduce pollutant formation by promoting lean combustion will also be investigated as well as systematic exploration of the chemical transformation of nitrogen oxides in sample lines and sample probes to identify the requisite guidelines for accurate measurement.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0012, DEVELOPMENT OF GAP-SI HETEROJUNCTION TRANSISTORS BY MOLECULAR BEAM EPITAXY 14570-EL

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To extend performance limitations of silicon devices by incorporation of metallurgically unfavorable heterojunctions. The objective is specifically, but not limited to, growth and study of bipolar transistors with gallium phosphide emitters on silicon base and collector structures. Relevance - this research will broadly contribute to the science and technology base of electronic and optical (integrated optics) devices. Impact on the state-of-the-art in transistors and photocathodes is expected.

Molecular beam epitaxial deposition techniques will be used to grow GaP on silicon taking advantage of existing Si technology. Lattice match, carrier transport and band gaps will be studied to verify theoretically predicted device performance improvements. The basic limitations of MBE will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0013, NEW METHODS FOR ANALYSIS OF THE PERFORMANCE OF GUIDANCE AND CONTROL SYSTEMS

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AF function - develop new estimation techniques for the design of high-accuracy guidance, navigation, and control systems for sophisticated Air Force systems. Deficiencies - the estimation or noise filtering problem in many cases is inherently nonlinear, and therefore not amenable to known linear filtering techniques. Objective - the objective of this research is to develop methods for routinely handling nonlinear filtering problems. How work contributes - better techniques for nonlinear filtering will find immediate application in improved performance and accuracy for complex systems.

Research will be conducted in five areas. The study of the optimal phase demodulation will be conducted on third- and fourth-generation digital systems. The code for the phase demodulation problem on the CRAY 1 will be improved to achieve 40 megaflops, in contrast to the current 22.3 megaflops. An attempt will be made to synthesize a four dimensional nonlinear filtering problem on the CRAY 1. Concurrently, a Monte Carlo evaluation of error performance of the four-dimensional problem will be attempted. A major effort will be continued on linking the theories of information and nonlinear filtering. Finally the investigation will begin on numerical techniques which will extend the realization possibilities of linear optimal filtering and control to systems of high dimension.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0014, TURBULENT VORTEX FLAME STABILITY AND SPREADING WITH GAS JETS AND SPRAY CONTROL HOMOGENEOUS IGNITION OF FUEL-AIR EXPLOSIONS

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AF function - advanced air-breathing combustion engines and chemical explosive weapons, weapon delivery and defense, close air support, transport. Deficiency - insufficient fundamental understanding of the basic mechanisms and processes associated with turbulent reacting vortex (swirl) flows in advanced air-breathing combustors under steady-state and transient conditions, and with programmed chemically sensitized homogeneous ignition and propagation of vortex combustion and unconfined fuel-air explosions. Objective - to formulate realistic analytical representations of gas jet-flame interactions and steady and transient ignition and flame phenomena associated with vortex stabilized combustion in advanced air-breathing combustors and with homogeneous ignition, flame and detonation propagation in vortex combustion and distributed fuel-air clouds. How work contributes - will provide additional understanding and realistic analytical modeling of the transient and steady-state behavior of turbulent reactive flow fields and of spontaneous reactive additives on programmed homogeneous ignition in vortex combustion and fuel-air clouds, and will contribute to establishing realistic guidelines for developing efficient, stable advanced air-breathing combustors and determining the feasibility of possible new single-event fuel-air explosive devices, and in the application of broad range alternate fuels such as those derived from shale and coal.

Study will be made of (1) mechanisms and processes of gas jet-flame interactions including investigation of gas jets used as fluid amplifiers to promote and stabilize vortex combustion, reduce combustion instability and combustion-driven noise, (2) flow-flame interactions of fuel sprays under realistic combustor conditions simulating behavior of mixed fuels, fuel impingement on hot surfaces, and (3) use of spontaneous reactive additives to provide programmed ignition in vortex combustion and fuel-air clouds. Included is study of the following -degree of amplification of the recirculation zone in cylindrical burners with cross jets and determination of optimum location and total jet flow rate, burner characteristics with air jets and determination of optimum location and total jet flow rate, burner characteristics with air jets performing the dual role of fluid amplifier and swirl generator with particular emphasis on causes of rough burning, spectral character of the pressure fluctuations. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0015, NON-LOCALIZED IMPACT IONIZATION IN SEMICONDUCTORS 12496-EL

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Measure and theoretically model ionization rates in both polar and nonpolar semiconductors. Direct impact of generated research results is expected on design and improvements of impatt diodes (microwave frequency oscillators) for use in radar, communication and EW and on understanding of high field transport constraints in field-assisted photocathodes.

Develop adequate description of carrier transport process mainly in GaAs and GaP in the high field region, distinguish between static and dynamic ionization rates, provide useful analytical results to be applied to device design.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0016, GROWTH AND CHARACTERIZATION OF EPITAXIAL PIEZOELECTRIC AND SEMICONDUCTOR FILMS

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AF function - microwave signal processing devices are essential components of Air Force communication, reconnaissance and electronic countermeasures systems. Opportunity - microwave signal processing devices can utilize surface acoustic waves (SAWs) to perform functions such as filtering, encoding and decoding, signal delay, and signal correlation or convolution. Optimum performance of these function is limited by the material used to support SAWs and improvements can be expected when

materials having more appropriate SAW properties are utilized. One such promising material is aluminum nitride on sapphire which holds the promise of high frequency operation with zero temperature coefficient of delay and relatively strong electromechanical coupling. Objective - the objective of this research is to develop the aluminum-nitride-on-sapphire material system to the point where it is useful for SAW device applications. More specifically, the problem areas of film thickness uniformity, strain-induced warping and acoustic property variations due to film microstructure imperfections will be addressed. How work contributes - this work will contribute to the field of SAW by providing a material which has a reasonable electromechanical coupling coefficient, which is capable of frequency operation twice as high as other standard materials and which should exhibit complete temperature stability for thicker films of aluminum nitride.

Experimental and theoretical research will be carried out to determine optimum conditions for the deposition of high-quality single-crystal AlN films on sapphire substrates, and to clarify the reaction kinetics and flow dynamics involved in AlN film preparation. The experience acquired from the AlN studies will be used to study various other interesting piezoelectric and semiconductor materials.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0017, ESTIMATION AND IDENTIFICATION FOR MODELING DYNAMIC SYSTEMS

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AF function - the study of dynamic models of Air Force systems. Deficiency - the mathematical models of aircraft navigation systems, jet engines, and flight control systems require frequent updates to reflect new information. Objective - the objective of this research is to develop state estimation and parameter identification techniques for causal functional equation models. How work contributes - success in this effect will result in new systematic approaches to system modelling at reduced cost.

This research effort is aimed at developing techniques for causal functional equation models. An investigation will be made on the minimum-variance state estimator, the counterpart of the extended Kalman filter, maximum-likelihood parameter estimators, and a layer-recursive approach for estimating parameters.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0018, FUNDAMENTAL PROBLEMS IN HIGH-ALTITUDE AERODYNAMICS

E.P. Muntz, University of Southern California, School of Engineering, Dept. of Aerospace Engineering, *3551 University Ave., Los Angeles, California* 90007 (DF014950; AFOSR-77-3142)

AF function - weaponry, propulsion and power, aerospace vehicles. Deficiency - lack of knowledge of vibrational and rotational energy distribution in nonequilibrium expansions from excited states in laser cavities and rocket plumes. Objective - to characterize nonequilibrium nozzle expansion flows of vibrationally and rotationally excited carbon monoxide, to determine the populations of the various quantum levels, and to determine the influence on these observations of the various rarefied plume parameters. How work contributes - this knowledge will be useful in understanding processes in gas lasers as well as in high-altitude rocket plumes.

Electron beam fluorescence will be used to measure nitrogen vibrational population distribution in mixtures with carbon monoxide and with argon in a discharge tube. Translational temperature and mixture ratio will be varied. In order to infer, in addition, the vibrational population distribution in the carbon monoxide, it will be calculated from the measured nitrogen distribution and the measured rotational temperature using the energy transfer model of Caledonia and Center. This procedure will then be verified by observing the agreement between predicted and measured gain coefficients for those cases where gain is found. Direct measurement of vibrational distribution in carbon monoxide by electron beam fluorescence has proven unfeasible.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0019, EFFECT OF SOLUTE-VACANCY PAIRS ON THE PHYSICAL PROPERTIES OF SI-DOPED GAAS, AND OTHER COMPOUND SEMICONDUCTOR SYSTEMS

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AF function - microwave electronic devices are essential elements of Air Force communications, reconnaissance, surveillance and countermeasure systems. Opportunity - improved performance of these systems can be expected from use of better materials in devices that process microwave signals. Present microwave solid-state device performance is limited by the defect structure in device materials. Objective - the objective of this research program is to obtain a more complete understanding of the defect structure of Si-doped GaAs and to track the effects of simple defect species on properties of GaAs that are important for signal processing devices. How work contributes -changes in quantities such as carrier density, infrared absorption, vacancy loop size and density, yield stress and luminescence caused by changes in thermodynamic conditions will be correlated and all explained on the basis of a common defect model.

The effect of varying concentrations of Si and thermal treatments on the free carrier concentration, infrared absorption, photoluminescence, critical resolved shear stress and defect structure of Si-doped GaAs will be systematically investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0020, INITIATION, COMBUSTION AND TRANSITION TO DETONATION IN HOMOGENEOUS AND HETEROGENEOUS REACTIVE MIXTURES

R.A. Strehlow, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Aeronautical & Astronaut Engin, *2527 Hydrosystems Lab., Urbana, Illinois* 61801 (DF049180; AFOSR-77-3336)

AF function - advanced chemical explosive weapons, weapon delivery with the MX missile using high-energy HMS propellants, missile and aircraft component vulnerability and survivability. Deficiency -insufficient understanding of basic mechanisms of chemical initiation, propagation, attenuation and quenching of blast waves and detonations in reactive media, e.g., single-event FAE III. Unscheduled transition to detonation in Navy C-4 missile using similar propellants planned for MX missile. Objective - to obtain better understanding and realistically model basic mechanisms of triggering detonations in a fuel-air clouds by use of chemical accelerants, and nonlinear initiation of detonation by finite amplitude waves in an incipiently reactive system, to develop general but accurate criterion describing the possibility of deflagration-to-detonation transition (DDT) in beds of granulated high-energy propellants and explosives, and to access possible DDT hazard of missile propellants. How work contributes - will provide (1) additional understanding of basic processes of chemical initiation of detonations, transition from deflagration to detonation (DDT), attenuation of flames, blast and detonation waves, (2) quantitative models a priori predicting properties, blast initiation requirements and damage potential of FAE clouds and DDT transition in granular propellants and explosives, (3) guidelines for evaluating and design of single-event FAE III explosive devices, effective flame and detonation arrestors, and safe, high-performance propellants in missile weapon systems.

The influence of local concentrations of reactive chemical promoters (accelerators) on initiation and transition to detonation of reacting clouds will be studied theoretically and numerically using an existing Lagrangian time-dependent finite-difference program (cloud) modified to include Arrhenius-type kinetics in the cloud and accelerated kinetics in the region containing the accelerant. Concurrently, detonation initiation of fuel-air mixtures by non-linear aerodynamic perturbances will be studied using reflected shock techniques and ramps or models to generate finite amplitude waves in an incipiently explosive region behind the reflected shock. Optimum ratios of vapor cloud size to

promoter spot size and optimum internal promoter concentration gradients will be determined which promote transition from adiabatic explosion to detonation. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0021, THE EFFECT OF ATMOSPHERIC PARTICULATE MATTER ON THE PROPAGATION OF A LASER BEAM 14372-GS

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To investigate the effects of nonsphericity of aerosols on the propagation of both visible and infrared laser beams through the atmosphere containing dust particles. Relevance - more precise definition of the scattering effects on nonspherical aerosols on laser propagation through the atmosphere will be applicable to the high-energy laser test experiments, the non-line-of-sight optical communications program, investigations of system performance of night vision sensor systems, the design and operation of terminal homing systems, and to laser remote sensing systems.

Calculate light scattered and absorbed by atmospheric dust assuming (1) spherical particles and using MIE theory, and (2) nonspherical particles and using an approximation method based on the assumption that surface waves are present in scattering by spherical particles and absent in scattering by irregular particles.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0022, FEASIBILITY STUDIES OF SPOILER AND AILERON CONTROL SYSTEMS FOR LARGE WIND TURBINE

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0023, COMPUTATION OF THREE-DIMENSIONAL AERODYNAMIC FLOW

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AF function - the design of reentry vehicles. Deficiency - no efficient method exists for computing complete flow fields past 3-D bodies at angles of attack. Objective - this research intends to develop efficient numerical and computational schemes for solving 3-D Navier-Stokes equations of flows past bodies at angles of incidence. How work contributes - techniques developed may be used in conjunction with wind-tunnel data for the design of reentry and aerospace vehicles.

This effort will investigate the solution of unsteady, three-dimensional, compressible, laminar Navier-Stokes equations by the use of an implicit splitting method which incorporates the unconditionally stable Crank-Nicolson schemes for the viscous flow and the basic Lax-Wendroff concept for the inviscid flow. Implementation in the form of a computer code for a Univac 1108 computer. The actual computations will be performed using GFE computer at Edgewood Arsenal.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0024, NONLINEAR INTERACTIONS BETWEEN LASER RADIATION AND SPIN-ALIGNED CARRIERS IN SEMICONDUCTORS

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AF function - secure space communication and covert optical electronics require devices which exploit the properties and interaction effects of materials with infrared radiation. Opportunity - infrared materials research has a high potential impact on novel detectors, sources and communications for airborne and spaceborne applications. Objective - there are five principal objectives in this research on semiconducting compounds: 1) to better understand details of the spin dynamics of recombining electron-hole pairs, 2) to study the spin-dependence of optical transitions near the fundamental absorption edge, 3) determine the gain and polarization properties of lasers in the presence of spin alignment, 4) study the effects of optical spin alignment on the output of laser amplifiers using polarized injection signals, 5) investigate techniques for fast switching of the polarization of infrared signals using spin-dependent phenomena. How work contributes - it is expected that this work will lead to a powerful technique for fundamental studies of semiconductors for fine probing of spin-dependent optical transitions, for studying spin dynamics in the formation of various band-edge complexes and for influencing stimulated emission processes. Optical spin alignment has far-reaching implications for the technology of semiconductor lasers as infrared sources and signal processing devices that are needed for optical communications.

The general approach will be to examine the intensity and analyze the polarization of emitted radiation in photoluminescent experiments under a variety of conditions. In simple preliminary optical spin alignment (OSA) experiments, a bulk sample will be used and the exciting radiation of arbitrary frequency will be circularly polarized. In experiments designed for detailed probing of the fundamental absorption edge, the high-intensity tunable output of an infrared dye laser pumped with a cavity dumped krypton ion laser will be used as the source of exciting light. To study effects of spin alignment on stimulated emission, resonator structures are being developed for oscillator and amplifier applications. Using such resonators, the effect of polarized pumping and polarized injection signals on the intensity and polarization of the output emission will be studied. Techniques for fast switching of laser output will evolve from the study of OSA interactions in stimulated emission. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0025, WIDEBAND INTEGRATED VOICE/DATA TECHNOLOGY

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The goal of this program is the investigation and development of techniques for communications-adaptive internetting with particular emphasis on digital voice communications. The specific class of problems addressed to packet speech networks whose interconnecting links may be stressed as a result of traffic overloads or are time-varying due to natural or hostile actions.

This program extends the technology of fixed-topology packet-switching speech communications networks by introducing techniques for adapting both source encoder algorithms and network utilization strategies to the time-varying character of the links in an attempt to provide sustained voice communications capability under adverse conditions. Attention is being directed toward the design of modems which can adjust their rates based on automatic assessment of channel capacity, and to the establishment of protocols through which individual voice terminals can adjust their rates based on changing conditions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Electronic Systems Div.

4.0026, STOCHASTIC AND ADAPTIVE SYSTEMS

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AF function - develop models and control systems for aircraft systems and their subsystems. Deficiency - the control of future aircraft that operate in a diverse environment. Objective - the objective of this proposal is to design stability augmentation systems and control systems that operate reliably over a wide operating envelope. How work contributes - success in the pursuit of this objective would enable engineers to design more accurate and more reliable controllers for use in important Air Force aircraft systems.

The problems of stochastic and adaptive systems will be investigated through six areas of research. The first area deals with modelling and realization theory for stochastic systems. A fundamental theory of modelling of stochastic systems will be an objective of this research. The second area will be concerned with nonlinear filtering and stochastic stability. Nonlinear filtering is the theory of estimating the state of a nonlinear system based on noisy measurements on the systems. The qualitative behavior (stability) of these filters will also be investigated. The third area is deriving approximations to nonlinear stochastic systems and nonlinear filtering. Specifically a fundamental study of obtaining volterra-type representations for nonlinear stochastic differential systems and nonlinear filters will be pursued. The fourth area is stochastic control. The research will continue on developing a geometrical theory of control for linear stochastic systems. The fifth area is investigating the robustness, reliability, and integrity of stochastic control systems. This research includes understanding the robustness properties of stochastic estimators and stochastic control systems based upon the linear-quadratic-control methodology, the development of the uncertainty threshold principle, and the issue of reliable control system designs in which multiple actuators are present. The final area is estimation and analysis of space-time processes. This research will include the study of optimal estimation problems involving random propagation delays and the observation of spatially distributed random processes.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0027, STUDIES RELEVANT TO THE INTERACTION OF SPACECRAFT WITH PLASMA

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AF function - AF communication and surveillance satellites have been affected deleteriously by interaction with energetic charged particles in the space environment. Environmentally induced ARC-discharges can cause loss of satellite command and telemetry communications and disrupt entire missions. Deficiency - anomalous behavior can occur in synchronous orbit satellites and satellites in lower orbits. The charging of the spacecraft by energetic electrons in the magnetosphere can produce large negative differential potentials and damaging discharges. Objective - develop a mathematical model of the time-dependent spacecraft-plasma interaction, and study low-frequency instabilities and shock wave structure which can generate energetic electron clouds in the geosynchronous plasma in excess of those associated with magnetospheric substorms. Contribution - provide a more complete understanding of the plasma environment at geosynchronous orbit and of the dynamic interaction of solid bodies and space plasmas.

(1) Spacecraft charging - a plane slab immersed in a neutral plasma is assumed to absorb all incident charge at some initial time. The model includes the dynamics of the resulting plasma sheath development, the propagation of ion acoustic waves into the plasma, the subsequent approach to the steady floating potential on the body and steady ion rarefaction wave connecting the wall potential to the undisturbed plasma. Ion temperature and electron inertial effects are neglected. (2) Shock wave propagation - the role of low frequency streaming instabilities on collisionless shock wave structure is extended to include the effects of oblique propagation on shock waves parallel to the ambient magnetic field and of ion reflection from the potential barrier of an ion acoustic subshock in a high Mach number parallel shock wave.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0028, MULTIPLE NUCLEAR BURST MODELING OF ENERGETIC ELECTRON INJECTION INTO THE MAGNETOSPHERE

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AF function - survivability of spaceborne systems. Deficiency -inadequate knowledge of the environment produced by multiple exoatmospheric nuclear bursts and the interaction of the radiation fluxes produced with advanced operational space systems as spelled out in the Air Force requirements document for nuclear weapons research. Research - environmental consequences of multiple nuclear burst and the interaction with space systems. How research contributes - the effects on particle trapping and loss from wave-particle interaction in the plasmas produced by multiple nuclear bursts are determined and the interaction of these radiation fluxes with space system is investigated. The streaming instabilities due to the coupling of collisionless debris plasma to collisional plasma are studied for the situation of a second nuclear explosion occurring inside a magnetic field-free contracting plasma bubble and particle fluxes calculated. The wave modes produced have been identified, and their effects on particle trapping, heating and loss have been studied. These results are being applied to determine their interaction with a high-altitude space system.

Exoatmospheric nuclear burst weapon debris particles injected to high altitudes will experience plasma instabilities between the expanding debris ions and background ionized air neutrals. The resulting energetic electrons will act as a source of electron injection into the Van Allen belts. Streaming instability interactions between the expanding debris ions and the background ions generate plasma turbulence. The turbulent modes will stochastically heat the resonant fraction of plasma electrons trapped in the interpenetrating field. The nonlinear wave-resonant particle interaction will determine the electron flux levels experienced by high-altitude satellites. Turbulence will be generated by numerous plasma streaming instability interactions. The research is an analysis of this turbulent collisionless injection mechanism and how it is modified when two or more nuclear devices are detonated in near proximity at high altitude and the nature of the interaction of this injected high-energy plasma and Air Force space systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0029, SIMULATION OF AIRDROP PLATFORM LOADS ON AIRCRAFT ROLLERS

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Before a given cargo is airdropped it is necessary to be certain that its weight and weight distribution are such that the loads it places on the aircraft rollers do not exceed the allowable loads. It is possible to make this determination experimentally, the current practice, or theoretically. There is presently no procedure available to carry out such a theoretical determination and it is the objective of this work to develop a theoretical model of the airdrop platform-aircraft roller interaction so that predictions of the roller loads can be made.

The model of the airdrop platform-aircraft roller interaction will require a theoretical structural model of the platform including variable mass distribution and a model of the behavior of the roller system under load. The roller loads are determined by solution of the platform structural model subject to the interaction of the rollers at flexible point supports distributed regularly over the platform. It may also be necessary to include irregularities such as roller height and platform unevenness in a statistical manner.

SUPPORTED BY U.S. Dept. of Defense, Army, Natick Research & Development Command

4.0030, MEASUREMENT OF SIZE DISTRIBUTION OF SUBMICRON PARTICLES USING NEW LASER DIAGNOSTICS

J.F. Driscoll, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Aerospace Engineering, *Ann Arbor, Michigan* 48104 (DF051730; AFOSR-78-3556)

AF function - improved diagnostic techniques, advanced rocket and air-breathing engines, weapon delivery and defense. Deficiencies -inability to obtain reliable in-situ measurement of important parameters (i.e., submicron particle size and distribution) in turbulent reacting flows in practical hostile combustion environment via present-day measuring and diagnostic techniques. Objective - to develop and improve theoretical for-

mulation of the correlation laser scattering process and computer model for data reduction, to determine capability and limitations of the correlation laser scattering technique as a laboratory diagnostic tool. How work contributes - will help evaluate capabilities, limitations and development of correlation laser scattering technique for accurate determination of submicron particle size and distribution in combustors and plumes under conditions not now possible, e.g., polydisperse aerosols under sub-atmospheric pressure. Will provide additional understanding and reliable data to permit realistic evaluation of complex reacting flow models, will help reduce development time and cost of air-breathing and rocket propulsion systems.

Major theoretical deficiencies associated with the use of a correlation laser scattering technique (i.e., laser doppler spectroscopy (LDS)) for submicron particle size measurements will be addressed. Primary emphasis will be placed on formulation of an improved theoretical model which properly accounts for particle drag at all pressures and adequately tests a distribution of particle sizes. Additionally, the existing LDS data reduction procedure (i.e., computer program) will be reformulated from basic principles to enable measurements to be performed in polydisperse aerosols under atmospheric and sub-atmospheric pressures. The computer program will be used to determine particle mean diameter and size distribution half width. Sensitivity of the results will be investigated and feasibility of future use of the technique in combustors and plumes will be deduced. Experimental data obtained during the summer study at AFRPL will be used as input.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0031, ROCKET EXHAUST PLUME MODEL STANDARDIZATION

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The objective of this work unit is to utilize the existing technology base to produce a standardized code for use by the tri-service/NASA community which models the low-altitude gasdynamic flow field structure of a plume exiting a vehicle in flight.

A mathematic model and computer code will be developed which will physically describe the low-altitude gasdynamic plume flow field from a rocket powered vehicle in flight. This requires modeling an external flow field in the Mach number range from static through subsonic to supersonic. The approach to accomplish this will take advantage of technological developments in this area over the past five (5) years. This effort will be a code standardization rather than a code development.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Aeroballistics Directorate

4.0032, ADVANCED AVIONIC SYSTEMS ANALYSIS

L. Youngblood, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Avionics Research & Development Activity, *Fort Monmouth, Red Bank, New Jersey* 07703 (DA0C3431)

Development of the software necessary for integration of advanced tactical avionics systems and participation in development of government/industry systems integration standards.

To participate in triservice/industry efforts to develop standards for advanced tactical avionic systems (these include standards for avionic software and multiplex hardware). To apply existing software operating systems (e.g., SKC-2000 assembly language, INTEL 8080 assembly language) to the design of software addressing current Army exploratory development problems. To perform the systems analysis necessary to support these efforts.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Avionics Research & Development Activity

4.0033, TRANSONIC WING-BODY CALCULATIONS

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The development of accurate methods for the prediction of the transonic flow fields about complex aircraft and missile configurations is essential for their design and optimization. The proposed research will develop finite-difference techniques for solving the complete potential equation for the transonic flow about three-dimensional configurations, such as wing-fuselage combinations.

The development of accurate predictive techniques for increasingly complex configurations is an evolutionary one. The planned research will extend the previous wing work of Jameson and Caughey to include the added complexity of a fuselage. Emphasis will be devoted to methods for transforming the geometries to computational domains in which the boundary conditions can be accurately and efficiently incorporated. Concomitant problems associated with the transformational procedures (the flow is not approximately aligned with one of the coordinate directions at all points in the field) will be studied. The investigation will be conducted within the framework of the complete potential equation differenced in a non-conservative form.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0034, ADVANCED ELECTRONIC FLIGHT CONTROL SYSTEM DEVELOPMENT (INTEGRATED SENSORY SUBSYSTEM)

W.D. Weinstein, Grumman Corp., Aerospace Corporation, *S. Oyster Bay Rd., Bethpage, New York* 11714 (DN881143; N62269-78-C-0051)

To develop a fail-operational, combat-survivable, and highly reliable angular rate sensor system for future Navy aircraft. This contract supports work unit ZA601, Agency Accession No. DN681080.

Design and fabricate the mechanical and electrical equipment necessary to install, instrument, check out, and flight test the ASSET III (advanced skewed sensory electronic triad) system in an A-6A aircraft.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

4.0035, QUASI-ORDERED STRUCTURES IN FREE TURBULENT SHEAR FLOWS

R. VaglioLaurin, New York University, School of Science & Engineering, Dept. of Aeronautics & Astronautics, *Washington Sq., New York, New York* 10003 (DF049650; F49620-77-C-0119)

AF function - aerospace vehicles. Opportunity - quasi-ordered structures are known to exist in turbulent shear flows. However, the sequence of the breakdown and position of the energy hierarchy from mean flow to the smallest eddies is only quantitatively understood. In the light of recent data, there is a possibility of quantitatively understanding and describing the nature, scale, interactions and attendant energy balances for the ordered structures that produce and maintain the turbulent character of the flow. Objective - to develop an analytical model for turbulent free shear flows from a wave mechanics view point that recognizes (a) the development of ordered structures, (b) the interaction among, and the agglomeration of, these structures, (c) the initiation of the turbulent energy cascade and the energy partition within them. How work contributes - if the objective of this effort is successful, the basis for the computation of turbulent flows will be on a firmer physical footing. It will also elucidate the mechanisms for producing and partitioning the turbulent kinetic energy. The predictive capabilities for advanced aerospace vehicles will be greatly enhanced by the new insights and quantitative evaluation available from models of this type.

The work will be an analytical effort to evolve the phenomenological description of the interactive mechanisms of the quasi-ordered structures developed in a turbulent shear flow. The first description will concentrate on the two-dimensional free shear layer. Close coordination with parallel experimental programs will be maintained.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0036, STUDIES OF INTERACTIONS OF ELECTROMAGNETIC FIELDS AND PLASMA BEAMS

B.R. Cheo, Polytechnic Inst. of New York, Brooklyn Campus, Graduate School, Dept. of Electrical Engineering & Electrophysics, *333 Jay St., Brooklyn, New York* 11201 (DF038340; AFOSR-74-2668)

AF function - operation of high-altitude vehicles in a post nuclear explosion environment, development of electromagnetic weapons, space and ionospheric communications as well as countermeasures demand the fundamental understanding of interactions of electromagnetic fields and plasma beams. Deficiency - the aforementioned information required for the design of advanced equipment is not available today. Its acquisition may be realized by a well-planned theoretical and experimental research program. Objective - this program will study the mechanisms of a self-sustaining plasma beam as a guiding structure for high-power electromagnetic fields at microwave frequencies. Contribution - this work is a part of a comprehensive program of plasma research for the development of an x-ray radiation source for simulation of nuclear weapon effects, the development of advanced electromagnetic weapons (laser and particle beams), the development of space and ionospheric communications, and the development of countermeasures.

This project will investigate the interaction of a high-power microwave radiation with a plasma beam. Specifically - (a) it will measure the microwave field along the axis of the plasma beam and radially and determine the phase velocity and attenuation, (b) it will compare the measurements with the theoretical results of the linear cylindrical plasma mode, (c) it will determine the balance of ionization versus the crossfield diffusion necessary for beam maintenance, (d) it will study the relation between the ion wave instability and the maintenance of the beam, (e) it will extend the foregoing to the high-power regime and higher neutral background pressure, (f) it will explore the capability of the axial magnetic field in maintaining the beam. As the enhanced anomalous diffusion is an important mechanism for beam maintenance and the saturation of parametric decay instabilities, diffusion processes will be investigated experimentally using equipment available in the laboratory.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0037, VISCOUS INTERACTING FLOWS

M.H. Bloom, Polytechnic Inst. of New York, Long Island Center, Graduate School, Dept. of Aerospace Engineering & Applied Mechanics, *Farmingdale, New York* 11735 (DF051110; F49620-78-C-0020)

AF function - advanced aerospace vehicles. Opportunity - increase the understanding of the mechanism of film cooling and improve the prediction and computational efficiency of viscous fluid flows. Objective - to study the effects of transpiration film cooling of slender, blunted conical bodies, both experimentally and analytically. How work contributes - this work will provide basic knowledge which can be applied to the design of the next generation of maneuverable reentry vehicles and will provide analytical tools to more efficiently utilize computer capabilities in the prediction of viscous aerodynamic flow fields.

An experimental, theoretical and analytical program to study the effects of liquid film cooling of slender blunted cones will be developed. Both zero and non-zero angle of attack effects, as well as the effect of cooling on the boundary layer transition, will be considered. A laser diagnostic system using argon-ion and one tunable dye laser will be developed to determine the concentration of water in both liquid and vapor form. The analytical studies will determine the applicability of high-order collation techniques as a tool for calculating this problem, as well as thicker, higher shear turbulent boundary layers.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0038, LASER INDUCED FORCED MOTION AND STRESS WAVES IN PLATES AND SHELLS

H. Reismann, State University of New York, Buffalo Campus, School of Engineering & Applied Science, Dept. of Engineering, *3435 Main St., Buffalo, New York* 14214 (DF042530; AFOSR-76-2943)

AF function - laser weapons technology continues to develop and Air Force flight vehicles may, in the future, be required to incorporate design-protection to avoid critical damage caused by possible radiation. Opportunity - the understanding of structural response to laser radiation will provide a basis for the development of survivability and vulnerability design improvement programs. Objective - the objective of this research is to develop sound theories which describe the time-dependent response of metallic structures to pulsed laser radiation. How work contributes - this research is part of the AFOSR program to provide a basic understanding of, and approaches to, structural behavior under exposure to those environments of concern to the USAF.

This research activity is subdivided into two phases, experimental and theoretical. As a result, the completed effort will provide a theoretical basis to predict structural response to radiation with companion data verification. Theoretically, the research will utilize basic elastic plate theory and three-dimensional elasticity. Experimentally, pulsed laser radiation will be applied to circular and rectangular clamped plates. Research will focus on describing the radiation-induced loading conditions on the plate and the resulting three-dimension material response of the plate. Both low- and high-energy deposition rates will be used such that plasma formation will occur. Vacuum chamber experiments are planned during the immediate phase of the effort.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0039, VLF/LF IONOSPHERIC PROPAGATION

J.E. Rasmussen, U.S. Dept. of Defense, Air Force, Rome Air Development Center, *Griffiss Air Force Base, Rome, New York* 13441 (DF904180)

AF function - communications, navigation and detection in the long-wave radio spectrum. Deficiency/opportunity - improve the range, reliability and survivability of VLF/LF communications. Improve the accuracy, predictability and reliability of VLF (OMEGA) navigation systems. The objective is to originate and develop new long-wave electromagnetic techniques which will significantly advance ionospheric radio propagation technology for Air Force communications, navigation and detection systems. This work will emphasize the evaluation and improvement of VLF and LF air-to-air system survivability in a nuclear environment. How research contributes - provides the experimental measurements and theoretical modeling required to understand long wave radio propagation under normal as well as severely disturbed ionospheric conditions and to determine the engineering parameters critical to VLF/LF system design.

The signal strength or coverage area for VLF and LF radio waves as a function of altitude is a critical propagation parameter for the design and evaluation of AF long-wave systems. Under this work unit a theoretical and experimental program will be conducted to determine the energy distribution of TE and TM polarized waves with altitude. This study will utilize balloon-borne dartsonde packages, rocket payloads and instrumented aircraft to measure both signal and noise as a function of polarization. The primary factor which controls the altitude distribution, and long-wave propagation in general, is the reflectivity of the lower ionosphere which will also be studied utilizing a high-resolution pulse ionosounder located in the arctic, where solar-related particle events provide the best available simulation of the low-altitude absorption features expected in a nuclear environment.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0040, ROLE OF ELECTRONICALLY EXCITED STATES AND FREE RADICALS IN UV-INDUCED LENS OPACIFICATION

H. Hacker, Duke University, School of Engineering, Dept. of Electrical Engineering, *Durham, North Carolina* 27706 (DF324380; F33615-78-C-0621)

The purpose of this research effort is to determine the nature of the involvement of electronically excited states and free radicals in ultraviolet (UV)-induced lens tissue opacification. Development of a model of UV-induced cataractogenesis will allow calculation of safe exposure levels for UV exposures from Air Force UV lasers.

Electron paramagnetic resonance (EPR) and spectrophotometry will be used as the primary investigative tools.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

4.0041, MODEL DEVELOPMENT FOR SHOCK WAVE BOUNDARY LAYER INTERACTION EXPERIMENTS

I. Greber, Case Western Reserve University, School of Engineering, Dept. of Mechanical & Aerospace Engineering, *University Cir., Cleveland, Ohio* 44106 (NSG 3271)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0042, RADAR CROSS SECTION STUDIES

L. Peters, Ohio State University, Columbus Campus, School of Engineering, Dept. of Electrical Engineering, *190 N. Oval Dr., Columbus, Ohio* 43210 (NSG 1613)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0043, CHAFF CLOUD MEASUREMENTS, ANALYSIS, AND DEVELOPMENT

V. Pyati, U.S. Dept. of Defense, Air Force, Avionics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF096990)

The objectives of this in-house effort are (1) to develop realistic computer models of chaff clouds that account for critical aerodynamic and electromagnetic effects, (2) to obtain and analyze radar cross section data from measurements of actual chaff clouds, (3) and to perform lab experiments and simulations to determine the signature of new chaff elements and their effects on advanced radars.

The objectives are to be achieved by in-house work and by utilizing and combining the work of various contractors. For example, computer programs to compute the RCS of a chaff cloud are being combined with aerodynamic programs that predict chaff element trajectores so that a time-varying RCS can be computed. In addition, in-house measurements of the RCS of redesigned chaff will be performed to evalute the improvements in electromagnetic performance. Measurements of the RCS and Doppler return from chaff clouds will also be performed and analyzed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0044, CHECKOUT AND DEMONSTRATION OF ENGINEERING FLIGHT SIMULATION MODELS FOR HYBRID COMPUTATION

J.J. Bankovskis, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF132880)

The mission this work unit supports is the simulation of advanced aerospace vehicles. The engineering flight simulator is a modern tool for the analysis and evaluation of current and future Air Force systems. The opportunity exists with simulations to develop proposed flight control system schemes including cockpit controls and displays. This requires man-in-the-loop participation throughout the design evaluation. Providing accurate, realistic mathematical models of flight simulation related tasks for increasing the adequacy and flexibility of modern flight simulation facility is the objective of this work effort. Tasks to be considered for implementation are simulation and evaluation of weapon delivery modes, navigational aids for terminal area operation, target images generated with a computer-generated image system and develop realistic turbulence of these and other flight simulation related tasks into a library of functional special purpose programs is necessary for improved flexibility and operational requirements in a facility which will actively participate in the design, development and evaluation of Air Force piloted systems.

The approach to be followed will be to assist the contractor in an active manner with the particular requirements of the engineering flight simulation facility computation equipment. This in-house support will continue through the checkout and demonstration of the contractor effort.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0045, COMPUTATIONAL FLUID DYNAMICS

W.L. Hankey, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF136270)

A deficiency exists in the ability to compute 3-D flow fields. The objective of this investigation is to develop three-dimensional numerical methods applicable throughout the flight corridor to solve the set of partial differential equations for fluid mechanics. The current design technique for developing a new USAF system requires approximately 20,000 wind-tunnel test hours, $50 million, and takes 4 years to accomplish. Use of numerical methods in the various phases of design can dramatically shorten this cycle.

In the past decade remarkable advances have occurred in the numerical computation of fluid flows. Advances in both computation methods and computer hardware have made this progress possible. The approach will be to develop numerical codes to efficiently solve various forms of the Navier-Stokes equations on the advanced computers.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0046, INSTRUMENTATION, FACILITIES AND TECHNIQUES FOR COLLECTING DYNAMICS AND LOADS DATA ON AIR FORCE WEAPON SYSTEMS

D.E. Seely, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF140280)

The broad problem facing the Air Force is to decrease life cycle costs of current and future aerospace weapon systems. Knowledge of the actual and expected flight and dynamic loads environments, is an essential requirement for the reduction of costs of Air Force weapon systems. The objective of this effort is to develop and improve sensors, instrumentation systems, facilities and techniques that are required for the collection and analysis of flight and dynamic loads data in an inexpensive, reliable and expeditious manner. This effort provides the equipment and facilities needed to collect and analyze the data required to validly define the loads environment of Air Force weapon systems. The data will provide the neccessities for identification, prediction, prevention and control of vibration, structural, dynamic, flutter and acoustical problem areas.

Evaluations, investigations, configurations, procurements, environmental tests and flight tests of various types of flight data acquisition systems, sensors and components will be performed to ensure compliance with accuracy, life, flight-worthiness, maintenance, size, performance, weight, reliability and safety requirements of loads data collection systems. Particular items of concern include multivoltage power supplies, integration circuits to increase dynamic range of dynamics data acquisition packages, detailed investigations of PCM techniques for dynamics data acquisition and investigations of magnetic bubble memories for use as a replacement for magnetic tape recorders. Future data acquisition requirements will be determined and appropriate instrumentation will be developed and procured. Improvement of facilities include technical evaluations of contractors reports, procurement of state-of-the-art shaker and shock test systems, an evaluation of a study contract let by ASD engineering to determine manning usage of existing facilities, and maintaining mobile facilities (vans). New vibration testing and analysis techniques will be studied in-house. Studies will include the purchasing or writing of required analysis computer in-house programs and conducting experimental programs to check current and proposed ground vibration techniques. Reports will be prepared presenting results and conclusions of the experimental programs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0047, ANALYSIS OF INTERNAL VISCOUS FLOWS USING THEORY OF SPUNES AND IMPLICIT NUMERICAL METHODS

K.N. Ghia, University of Cincinnati, School of Engineering, Dept. of Aerospace Engineering, *101 Baldwin Hall, Cincinnati, Ohio* 45221 (NSG 3267)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0048, OPERATION, MAINTENANCE AND ENGINEERING SERVICES IN SUPPORT OF BIOENVIRONMENTAL NOISE RESEARCH

W. Hovey, University of Dayton, School of Engineering, Dept. of Electrical Engin, *300 College Park Ave., Dayton, Ohio* 45469 (DF323390; F33615-78-C-0500)

The high-level noise environments generated by many Air Force weapon systems and equipment are a physical hazard to air and ground crew personnel who must function in these environments to assure mission success. These same noise sources pollute the environment in areas adjacent to ground and flight operations. The magnitude and character of these physical environments must be known to evaluate environmental impact, assess bioacoustic effects, and resolve noise-related operational problems. The objectives of this service contract are to provide technical procedures, equipment performance data, and software, and to operate and maintain equipment/facilities required by the Biodynamic Environment Branch (AMRL/BBE) for acquiring, storing, retrieving and processing bioenvironmental noise data. These services support work units 72310433, 72310434, 72310435, 72310436, 72310437, and 72310341 which provide environmental noise data and predictive models to AF/PREV, ASD System Program Offices, and MAJCOM/Base bioenvironmental and civil engineers for use in assessing compatible land use (Air Installation Compatible Use Zone Program), environmental noise impact (AFR 19-2), and exposure/protection of personnel (AFR 161-35).

Operate and maintain the AMRL NOISEBANK and computer interface systems for storing, retrieving, and processing acoustic data. Modify and expand the AMRL OMEGA series software used to analyze, extrapolate and predict noise environments. Operate a CDC 6600 computer system as required to prepare community noise contours using NOISEMAP. Modify and apply procedures and equipment for evaluating performance characteristics of acoustic transducers, data acquisition/analysis systems and noise simulators. Operate and maintain the AMRL DPC in support of AMRL experimental research.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

4.0049, STRESS CORROSION ENVIRONMENTAL EFFECTS ON AF 1410

V. Damiano, Franklin Inst. of the State of Pennsylvania, *20th & Benjamin Franklin Pkwy., Philadelphia, Pennsylvania* 19103 (DF048780; AFOSR-77-3341)

AF function - AF flight vehicles each exhibit different reactions to environmental effects. Serviceability of AF vehicles must be improved, especially for the problem of stress corrosion. Opportunity -the combined effects of stress and corrosion on the loss of ductility and stiffness for exploratory AF steels is an unknown area that requires scientific exploitation. Objective - this proposed work is to compare the stress corrosion susceptibility of AF 1410 parent material, heat-affected zones and weldments in both aqueous and gaseous environments using a fracture mechanic approach. How work contributes - the research would contribute to the better understanding of problems relating to fatigue, fracture and environmental effects.

Experimentally this program will consider these variables of stress corrosion - sample location and condition, aqueous and gaseous susceptibility, method of testing, welding variables and cathodic polarization. Analytically, the data will be characterized using fractography and in situ stress corrosion cracking observations so that models may be developed to predict, prevent and control the problem of stress corrosion.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0050, SPECTRUM ANALYZER, HP MODEL 8568A

K. Bittner, Hewlett Packard Co., *King of Prussia, Pennsylvania* 19406 (FA78NA-5051; FA161605 (TRAIS NO.))

The supplies hereunder shall accord with the Manufacturers current specification for the Model Number as spelled out in Item One. The Specifications are hereby incorporated by reference herein and made part hereof.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

4.0051, DATA CORRELATION AND ACQUISITION PROGRAM - DCA

R.K. Mattews, Arnold Research Org. Inc., *Arnold Air Force Base, Tullahoma, Tennessee* 37389 (DF420985; F40600-77-C-0003)

To define aerodynamic heating and thermal environmental effects on the design and operation of externally-carried stores requires both a wind-tunnel and flight-test program which will yield not only the primary data such as store temperatures, but also aerodynamic measurements of heating rates and pressure distributions, and therefore a specially designed airborne data acquisition system for measuring and recording of test data for subsequent analysis is needed.

A multichannel data system will be designed and fabricated to acquire and record wind-tunnel/flight-test data. The system will be designed to fit into existing external stores such as the BDU-12 and will be completely self-contained. Measurements on the store (in the wind tunnel and in flight) will include temperature, pressure, heat-transfer rate, time, and voice channel. Checkout of the data acquisition system will be accomplished in the wind tunnel and in flight.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Arnold Engineering Development Center

4.0052, TRANSONIC SLOTTED WIND-TUNNEL WALL BOUNDARY LAYER FLOW STUDY

J.M. Wu, University of Tennessee, Knoxville Campus, School of Engineering, Dept. of Mechanical & Aerospace Engineering, *W. Cumberland Ave. S.W., Knoxville, Tennessee* 37916 (NSG 2379)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

4.0053, THE INFLUENCE OF HOLD TIMES ON FATIGUE CRACK GROWTH OF ALUMINUM ALLOYS

H.L. Marcus, University of Texas, Austin Campus, School of Engineering, Dept. of Mechanical Engineering, *200 W. 21st, Austin, Texas* 78712 (DF042770; AFOSR-76-2955)

AF function - the longevity, reliability and life-cycle costs of aerospace structures are related to the fatigue properties of the structural materials used. In fact, the fatigue properties of structural materials often limit their application, as well as the performance of the system in which they are incorporated. Thus, it is important to understand the mechanism of fatigue. Opportunity - one of the areas in fatigue crack propagation that has not been investigated in any depth is the influence long hold times under stress have on subsequent fatigue crack growth. This information on the relaxation behavior at the crack tip is vital since the general testing techniques in evaluating materials and structures use accelerated time schedules and are not representative of normal operation of a system. Objective - this research will establish how crack tip relaxation effects, resulting from long hold times, will influence subsequent fatigue crack propagation in aluminum alloys. How work contributes - understanding the relationship between accelerated and real-time fatigue crack growth behavior is particularly important if mechanisms such as retardation of fatigue crack growth are to be related to design parameters.

The relaxation studies will be performed on 2000 and 7000 series aluminum alloy samples to which simulated cyclic stress-strain damage has been done, and the data correlated with direct measurements at the crack tip of compact tension and center-crack specimens. The influence of a variety of loading conditions and changes in microstructures will be studied to establish the important metallurgical variables involved. In addition, the role of the crack closure concept in fatigue crack growth will be studied

in detail, and the effects of humid environment on both crack closure and relaxation behavior will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0054, AN IMPROVED MODEL FOR SWITCHING CONVERTER POWER STAGES
F.C. Lee, Virginia Polytechnic Inst. & State University, Graduate School, *Blacksburg, Virginia* 24061 (NSG 3274)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0055, DEVELOPMENT OF WATER MANAGEMENT SYSTEMS FOR CROP PRODUCTION UTILIZING SOIL, CROP AND AGRO-ENVIRONMENTAL MONITORING SYSTEMS DATA
N.L. Powell, Virginia Polytechnic Inst. & State University, School of Agricultural & Life Sciences, Dept. of Agronomy, *Blacksburg, Virginia* 24061 (NSG 6031)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Wallops Flight Center

4.0056, AGRO-ENVIRONMENTAL MONITORING AND MANAGEMENT MODEL DEVELOPMENT AND IMPLEMENTATION PROGRAM
N.L. Powell, Virginia Polytechnic Inst. & State University, School of Agricultural & Life Sciences, Dept. of Agronomy, *Blacksburg, Virginia* 24061 (NSG 6030)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Wallops Flight Center

4.0057, DEMONSTRATION OF A PEANUT LEAFSPOT ADVISORY SYSTEM BASED ON AGRO-ENVIRONMENTAL MONITORING SYSTEM DATA
N.L. Powell, Virginia Polytechnic Inst. & State University, School of Agricultural & Life Sciences, Dept. of Agronomy, *Blacksburg, Virginia* 24061 (NSG 6029)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Wallops Flight Center

4.0058, INJECTION, ATOMIZATION, IGNITION AND COMBUSTION OF LIQUID FUELS IN HIGH-SPEED AIRSTREAMS
J.A. Schetz, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Aerospace Engineering, *Blacksburg, Virginia* 24061 (DF029130; AFOSR-78-3485)

AF function - advanced air-breathing engines, external burning systems, weapon delivery and defense, transport. Deficiency - insufficient fundamental understanding of the problems associated with high-speed combustion phenomena in advanced practical combustor systems and lack of realistic guidelines for predicting injector/mixing system and combustor/propulsion system performance and operational characteristics and selection of acceptable liquid fuels. Objective - to formulate realistic analytical models describing the detailed physical and chemical processes involved in advanced turbojet and ramjet combustor concepts and external burning systems. How work contributes - will provide improved understanding and realistic analytical modeling of injection, breakup, mixing, vaporization and ignition phenomena not now available and will contribute to establishing guidelines and criteria for choosing acceptable fuels and in design and development of practical injector mixing systems and combustors of advanced engines, e.g., turbojet main-and after-burner, dump-vortex burners, dual-mode scramjet, and external burning systems.

Detailed experimental observations will be made of penetration, breakup, atomization and ignition of liquid jets injected across a high-speed airstream in subsonic, transonic and supersonic facilities at various Mach numbers, and including conditions associated with external burning and 'dump combustors.' Emphasis will be directed toward understanding the basic fracture mechanisms, vapor pressure effects on the atomization process and the influence of liquid accumulation on the surface on near field ignition processes. Ignition and combustion processes on liquid surface layers in the region of the injection port will be studied in a specially constructed electrically heated air facility with a combustion-fired afterburner. Flow fields, atomization, vaporization and diffusion rate, and ignition and combustion details will be determined optically.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0059, EXPERIMENTAL INVESTIGATION OF UNSTEADY SEPARATION 12680-E
D.P. Telionis, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Engineering Science & Mechanics, *Blacksburg, Virginia* 24061 (DA0C5570; DAHC04-75-G-0067)

To investigate experimentally the flow properties in the neighborhood of separation within an unsteady boundary layer in an effort to verify the Sears-Telionis concept of unsteady separation. Relevance - the dynamic stall problem which occurs on the retreating blade of an advancing helicopter rotor can be explained in terms of an unsteady turbulent boundary layer separation. The description of this physical process is based on the Sears-Telionis unsteady separation concept. This concept is fundamental to all dynamic stall research work being carried out at AMRDL-Ames Directorate.

A glycerin-water mixture will be used to yield low Reynolds numbers and thick boundary layers with reasonable velocities. Separation will be induced by time-dependent adverse pressure gradients. Hydrogen bubbles and ink dyes will be used for flow visualization.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0060, LITHIUM-BASED ANODES FOR SOLID-STATE BATTERIES
B.C. Steele, University of London, *Senate House, London, England, United Kingdom* (DF050190; AFOSR-77-3460)

AF function - a variety of communications and flight operations depend on auxiliary battery sources for power. Deficiency - lightweight, longer-life, high-energy density batteries are required to meet operational needs. Objective - this research involves determination of thermodynamic and transport properties of materials that could function as solid-state electrolytes and anodes. How work contributes - research results should permit new superionic materials to be developed and permit understanding of ion transport mechanisms. Materials may be of use in practical battery systems employing solid electrolytes.

Transport properties and thermodynamics of selected intermetallic compounds that could operate as lithium solid solution anodes would be studied. Thin solid-state electrolyte films of lithium nitrides and lithium oxy nitride would be prepared by several methods and properties compared. Interface processes between lithium-containing anode and solid electrolytes will be examined.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0061, INVESTIGATIONS INTO THE TECHNOLOGY REQUIRED TO RAISE RELIABILITY LEVELS OF MAGNETIC SUSPENSION SYSTEM
M.J. Goodyer, University of Southampton, *Southampton, England, United Kingdom* (NSG 7523)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, SCATTERING OF LIGHT BY AMMONIA CRYSTALS
M.G. Tomasko, University of Arizona, Lunar & Planetary Lab., *Tucson, Arizona* 85721 (NSG 7573)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0002, TERRESTRIAL ANALOG STUDIES OF RELATIONSHIPS
M.J. Drake, University of Arizona, School of Liberal Arts, Dept. of Planetary Sciences, *Tucson, Arizona* 85721 (NSG 7577)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0003, GEOCHEMICAL EVOLUTION OF THE MOON AND IGNEOUS METEORITES
M.J. Drake, University of Arizona, School of Liberal Arts, Dept. of Planetary Sciences, *Tucson, Arizona* 85721 (NSG 7576)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0004, PLANETARY AERONOMY AND RELATED STUDIES
D.M. Hunten, University of Arizona, School of Liberal Arts, Dept. of Atmospheric Science, *Tucson, Arizona* 85721 (NSG 7558)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0005, ENGINEERING SERVICES
J. Labuda, Aerojet Liquid Rocket Co., *P.O. Box 13222, Sacramento, California* 95813 (DF582230; F19628-77-C-0182)

Objective - the goal of the contract effort is to provide launch vehicle services, analytical services and an attitude control system (ACS) to maintain specific pointing angles of a sounding rocket payload.

The contractor provides launch support as required at White Sands Missile Range, the engineering analytical support at the plant in Sacramento, California as directed. The ACS technical support personnel is based at the plant and will provide engineering, air bearing testing integration with the payload, and field services for the ACS at WSMR.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0006, VIKING INORGANIC CHEMICAL ANALYSIS EXPERIMENT - DATA ANALYSIS AND LABORATORY SIMULATIONS
A.K. Baird, Claremont Colleges, Pomona College, Undergraduate School, Dept. of Biology, *Claremont, California* 91711 (NSG 7566)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0007, CHATANIKA RADAR CORRELATIVE ANALYSIS
R.R. Vondrack, S R I International, *300 Ravenswood Ave., Menlo Park, California* 94025 (DF580700; F19628-78-C-0081)

AF function - communication, surveillance, and reconnaissance. Deficiency - inadequate knowledge of electric fields seriously degrade AF systems at high latitudes. Objective - to determine ambient electric fields, current flow and charged particle density and temperature from ground-based observations in the high latitude ionosphere and perform a correlative analysis with satellite observations. How research contributes - the deduction of the electrical structure of the ionosphere below the S3-2 satellite together with the satellite measurements will lead to improved ionospheric models in vicinity of auroral arcs and the mid latitude trough.

Correlative data from the Chatanika radar and the S3-2 satellite is analyzed to determine ionospheric electric fields, currents and plasma density and temperature. The results will be used to modify and update existing ionosphere electron density models.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0008, DYNAMIC OBSERVATIONS OF SOLAR MAGNETIC AND VELOCITY FIELDS
J.M. Wilcox, Stanford University, Inst. for Plasma Research, *Stanford, California* 94305 (ATM7720580A01)

This grant will continue the integrated light measurements of the solar magnetic field made daily at the Stanford Solar Observatory. The instrument used is a Babcock-type magnetograph attached to a 23 m vertical Littrow spectrograph. The mean field measurement represents a weighted average of the net magnetic field on the visible disk of the sun.

These observations of the mean solar magnetic field are now being shared with scientists throughout the world through publication in 'Solar-Geophysical Data', published by the National Oceanic and Atmospheric Administration and by the National Geophysical and Solar-Terrestrial Data Center in Boulder, Colorado.

The data will be used at Stanford to develop further the similarities between the observed properties of equatorial coronal holes and the solar magnetic sector structure. These similarities include rigid rotation, a lifetime of several solar rotations, the location of the equatorial coronal hole in the middle of a magnetic sector with an extent in latitude from one polar region to 25 or 30 degrees on the other side of the solar equator, and the geomagnetic enhancements associated with coronal holes and with the middle portion of solar magnetic sectors. Further investigations of the terrestrial effects of coronal holes will be pursued.

An attempt will be made to observe the so-called pulsations of the sun with a period of approximately 160 minutes. The overall aim is to study the sun as a star and elucidate the way in which it controls the terrestrial environment.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0009, THERMAL BEHAVIOR OF THE MARS ATMOSPHERE
T.Z. Martin, University of California, Los Angeles Campus, Graduate School, *405 Hilgard Ave., Los Angeles, California* 90024 (NSG 7594)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0010, THERMAL BEHAVIOR OF MARTIAN REGIONAL AND LOCAL FEATURES
H.H. Kieffer, University of California, Los Angeles Campus, Inst. of Geophysics & Planetary Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (NSG 7583)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0011, VIKING ORBITER COMBINED INFRARED STUDIES OF MARS ATMOSPHERE AND SURFACE
H.H. Kieffer, University of California, Los Angeles Campus, Inst. of Geophysics & Planetary Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (NSG 7582)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0012, THERMAL BEHAVIOR OF THE MARTIAN NORTH POLAR REGION DURING FALL, WINTER AND SPRING
H.H. Kieffer, University of California, Los Angeles Campus, Inst. of Geophysics & Planetary Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (NSG 7581)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0013, COMMUNICATIONS - MAGNETOSPHERIC SUBSTORMS
R.L. McPherron, University of California, Los Angeles Campus, Inst. of Geophysics & Planetary Physics, Dept. of Geophysics & Planetary Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (DN023137; N00014-75-C-0396)

The ionospheric disturbances associated with geomagnetic storms degrade or disrupt naval communications, navigation, and surveillance systems. The objective of this program is to develop an understanding of the triggering mechanism, evolution, location, extent and magnitude of geomagnetic storms required to predict their occurrence and effects on naval electromagnetic systems.

Ground and satellite magnetometer data is used to monitor electric currents in the magnetosphere and ionosphere during magnetic substorms. A complete data base will be developed for the IMS period. The formation of partial ring currents and its relationship to solar wind parameters and the role of magnetic micropulsation in triggering substorms is investigated.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0014, INVESTIGATION OF THE WAYSIDE BOUNDARY REGION PLASMA AND MAGNETIC FIELD
G.L. Siscoe, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Meteorology, *405 Hilgard Ave., Los Angeles, California* 90024 (NSG 5351)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0015, MODELS FOR NUMERICAL SIMULATION OF GRAVITY WAVES AND CLEAR AIR TURBULENCE FORMATION
M.G. Wurtele, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Meteorology, *405 Hilgard Ave., Los Angeles, California* 90024 (NSG 4024)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Dryden Flight Research Center

5.0016, SYNCHRONOUS ALTITUDE ATLAS
S.E. Deforest, University of California, San Diego Campus, Graduate School, Dept. of Physics, *P.O. Box 109, La Jolla, California* 92037 (DF247760; F19628-77-C-0014)

AF function - AF satellite systems operate at synchronous altitudes where charging occurs and this in turn produces systems anomalies and degradation. Deficiency - the plasma environment responsible for spacecraft charging is not well understood. Objective - to develop an environmental specifications of the geosynchronous plasma and field environment. How research contributes - plasma data from ATS-5 and 6 satellites will provide an environmental specification of the operating environment for AF synchronous satellites. The data will be used to typify the geosynchronous plasma environment's characteristics such that satellite charging mechanisms may be understood.

The University of California at San Diego will perform statistical analyses of the geosynchronous plasma parameters and their relation to charging events. An environmental data atlas based on ATS-5 and 6 data will be prepared to include plasma parameters typifying quiet and disturbed conditions. The atlas will serve as the basis for a geosynchronous environmental specification.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0017, OCEAN OPTICAL PROPERTIES
R.W. Austin, University of California, San Diego Campus, Scripps Inst. of Oceanography, *P.O. Box 1529, La Jolla, California* 92038 (DN875470; N00014-78-C-0566)

The objective of this work is to develop a data base and model for the optical properties of large ocean areas.

Measurements obtained with the Nimbus-G multispectral scanner will be analyzed to determine the optical properties of ocean waters.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0018, USE OF COLLATERAL INFORMATION TO IMPROVE LANDSAT CLASSIFICATION ACCURACIES
J.E. Estes, University of California, Santa Barbara Campus, School of Letters & Science, Dept. of Geography, *Santa Barbara, California* 93106 (NSG 2377)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0019, MAGNETIZATION OF LUNAR SAMPLES
M.D. Fuller, University of California, Santa Barbara Campus, School of Letters & Science, Dept. of Geological Sciences, *Santa Barbara, California* 93106 (NSG 7586)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0020, A STUDY OF ATMOSPHERIC DEVELOPMENT OF EXOSPHERIC PLANETARY BODIES
D.E. Shemansky, University of Southern California, Graduate School, *3551 University Ave., Los Angeles, California* 90007 (NSG 7595)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0021, REMOTE SENSING STUDIES
F.I. Gonzalez, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., *Boulder, Colorado* 80302 (87130228)

PROJECT OBJECTIVE: Enhancement of about 50 selected LANDSAT images for ARPA internal wave report. Participation in CZCS verification experiment. Support of Marine Electromagnetics studies.

CURRENT YEAR PLAN: Select and enhance about 50 LANDSAT images, using the Muirhead, for the ARPA internal wave report. Prepare E-M field equipment for monitoring transport in Florida Straits.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab.

5.0022, HAZARD RATING CRITERIA FOR SPRUCE BUDWORM SUSCEPTIBLE FOREST STANDS
R.C. Heller, University of Idaho, Forest Wildlife & Range Experiment Station, Dept. of Forest Resources, *Moscow, Idaho* 83843 (0075669; IDA-ES-0149)

OBJECTIVE: Identify and select study sites within infested and noninfested host stands which exhibit a variety of site, habitat and stand conditions; examine both low- and high-altitude aircraft photography for improved detection and evaluation of spruce budworm damage.

APPROACH: The investigation utilizes remote sensing techniques to identify and evaluate spruce budworm related damage. The investigation has been divided into several stages. Stage I, the first year of the project, will be directed towards the establishment of suitable study areas, plots and experimental procedures. Flight lines will be established and evaluation of potential independent variables will be accomplished during this stage. Variations in site characteristics displayed by infested and non-infested stands will be sampled in numbers sufficient for proper repliction and coverage of the range. Experimental procedures and selection of study sites will be accomplished in cooperation with Karel Stoszek's hazard prediction studies on the spruce budworm.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Idaho

5.0023, AIRBORNE MAGNETOMETER STUDIES
H.L. Yarger, State Geological Survey, *State Office Bldg., Topeka, Kansas* 66612

Program includes data acquisition at a rate of approximately 20,000 line-miles per year, generation of machine contoured maps at a 1:125,000 scale, development of computer programs for interpretation analysis, interpretation of data for geological meaning, and magnetic susceptibility measurements of wall cuttings and cores. The study permits a relatively fast economical method of evaluating deeply buried structures through mapping of small changes in the earth's magnetic field by the airborne magnetometer. Results should provide guidance to exploration for oil and gas and other minerals.

ADDENDA: This project is also supported by: Kansas State Government.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Unspecified Unit

5.0024, NAVY ENVIRONMENT - COASTAL DYNAMICS IN A BROAD, SHALLOW SHELF REGION

S.P. Murray, Louisiana State University, Agricultural & Mechanical College, Coastal Studies Inst., *University Station, Baton Rouge, Louisiana* 70803 (DN575175; N00014-75-C-0192)

The objective of this research is to determine the role that broad, shallow continental shelves play in modifying regional shallow water processes (winds, waves, currents, water temperature gradients, sediment transport), the way these modified processes act across the shelves, and how these processes effect coastline morphology. Navy/Marine Corps amphibious, swimmer, mine deployment and ASW operations can all be drastically affected by the complex processes operative in broad, shallow shelf areas, and an improved understanding of these processes is therefore desirable.

The second major field investigation of this project will take place in the area of the Mosquito Bank, Nicaragua. Current meters will be deployed along and across the shelf. The Lagrangian current field will be determined with suites of OTH-radar-tracked drogues. The water mass field will be examined with Plessey STD systems. Spatial distribution of sea-surface temperature will be determined with an airborne precision radiation thermometer. The thermal structure of the atmospheric boundary layer will be studied with acoustic radar and balloon sounding systems. All data will be correlated with high-resolution imagery from the DMSP or GEOS satellites.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0025, EVALUATION OF ACQUISITION AND ANALYSIS OF HYDROLOGIC DATA

R.K. Farnsworth, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Weather Service, Office of Hydrology, Hydrologic Research Laboratory, *Silver Spring, Maryland* 20910

OBJECTIVE OF PROJECT: To optimize current methods of data acquisition, evaluate additional potential sources of data (radar and satellites), and to improve and standardize processing of Hydrologic Data in support of runoff forecasts of the National Weather Service. This study is oriented toward rainfall and evapotranspiration.

DESCRIPTION OF PROJECT: Project includes three subareas: 1) Network and forecast systems modeling to estimate net benefits that could result from automation, relocation, or addition to current data networks. Systems analysis methods are used to model the mean areal estimation errors for different effective gage densities. Network performance, forecast operations, and user response to warnings are simulated. The Susquehanna River, including 40 forecasts above Harrisburg, Pa., is used as an example. Results from this study will be extrapolated to determine nationwide results. 2) Findings of the above study will be applied to evaluate various forms of radar and satellite data in the warning system. 3) The extended use of real-time point measurements and areal estimates of potential evapotranspiration will be studied to determine (1) locations and seasons when long-term means provide sufficient data and (2) when current observations are necessary, appropriate methods of arriving at areal average values; and the proper ways of estimating missing stations for existing pan and/or synoptic stations.

SUPPORTED BY U.S. Dept. of Commerce, National Weather Service, Office of Hydrology

5.0026, R AND D STUDIES

Unknown, Analytics Inc., *Bedford, Massachusetts* (DF580130; F19628-78-C-0083)

Research - atmospheric, stratospheric and ionospheric studies. How research contributes - development of signal analysis techniques to improve communications.

Using filtering, statistical, Fourier and nonlinear optimization techniques to study noisy data obtained from space probes.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0027, COMPUTATIONS OF SEA SURFACE MICROWAVE BRIGHTNESS TEMPERATURE

J. Alishouse, Geo Atmospherics Corp., *Box 117, Lincoln, Massachusetts* 01773 (7-631; M0-A01-78-00-4010 MOD 1)

OBJECTIVE: The objective of this study is to develop a model and appropriate computer codes that will permit the computation of brightness temperatures from microwave radiances for a finite field-of-view.

APPROACH: Utilizing the antenna pattern of the SEASAT-A Scanning Multi-frequency. Microwave Radiometer (SMMR) and sea surface brightness temperatures, the contractor will develop a mathematical model which performs the necessary integration over the field-of-view defined by the antenna pattern. This model will then be coded for digital computers to permit the actual calculation of brightness temperatures.

CURRENT PLANS: To have some results available for a SEASAT Users meeting scheduled for December 1978.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0028, LASER SPECTROSCOPY STUDY

R. Eng, Laser Analytics Inc., *38 Hartwell Ave., Lexington, Massachusetts* 02173 (DF248490; F19628-77-C-0015)

AF function - defense satellite program, infrared backgrounds, atmospheric laser transmission. Deficiency - the absorption of radiation in the atmosphere in the window regions is poorly understood and is a limitation on IR imaging systems, target detection, and laser transmission. Objective - by making high-resolution spectral measurements in the frequency regions of low absorption under a wide range of pressures, temperatures, and absorber amounts, the origins and experimental evidence for absorption in this region will be determined. Tunable diode lasers will be used. How research contributes - the results of this research will have direct applicability to the continuum and weak line transitions contained in the AFGL modeling codes.

Tunable laser spectroscopy will be performed in the atmospheric window regions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0029, LOW-ALTITUDE SPACECRAFT CHARGING ANALYSIS

M. Smiddy, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF249060)

AF function - surveillance, communication, magnetospheric modelling and spacecraft charging. Deficiency - inadequate knowledge of space vehicle interaction with its environment and all factors influencing charging. Objective - to use existing data to study charging effects at low altitudes. How research contributes - permits improved military space vehicle design for communication and surveillance systems, provides solution of spacecraft charging problems.

Experimental data, already in-house, from instruments flown on S3-2 and INJUN V polar orbiting satellites will be examined to determine environmental and surface material factors which influence vehicle charging.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0030, NEUTRAL MASS SPECTROMETRY DEVELOPMENT FOR A COMETARY MISSION
G.R. Carignan, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Electrical Engineering, *Ann Arbor, Michigan* 48104 (NSG 7587)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0031, CONDENSATE PHENOMENA IN THE POLAR REGIONS OF MARS
P.B. James, University of Missouri, St. Louis Campus, School of Arts & Sciences, Dept. of Physics, *8001 Natural Bridge Rd., St. Louis, Missouri* 63121 (NSG 7563)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0032, EVOLUTION OF MARS
K.A. Goettal, Washington University, Graduate School, *Brookings 220, St. Louis, Missouri* 63130 (NSG 7578)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0033, THE GEOMORPHIC ROLE OF WATER ICE ON MARS
S. Judson, Princeton University, Graduate School, Dept. of Geological Science, *205 Nassau Hall, Princeton, New Jersey* 08540 (NSG 7568)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0034, EVALUATION OF TETHERED KITE ANEMOMETER
K.E. Kunkel, U.S. Dept. of Defense, Army, Electronics Research & Development Command, Atmospheric Sensing Div., *White Sands M.R., Las Cruces, New Mexico* 88002 (DA0F2135)

The objective of this ILIR is to evaluate a tethered kite anemometer for possible application in determing wind profiles over complex terrain. This anemometer may provide an economical tool for determining wind fields at potential high-energy laser systems test facilities.

The tethered kite anemometer will be purchased, calibrated with tower anemometers and tested in the field for ease of operation and reliability. The response characteristics of the anemometer will be evaluated. An attempt will be made to run a field test at North Oscura Peak to evaluate its usefulness at remote sites.

SUPPORTED BY U.S. Dept. of Defense, Electronics Research & Development Command, Atmospheric Sciences Lab.

5.0035, INVESTIGATION OF TROPOSPHERIC RAINOUT PROCESSES
Unknown, Brookhaven National Lab., *Upton, New York* 11973 (FA78WAI-859; FA161284 (TRAIS NO.))

In order to determine the significance of the ultimate tropospheric sink for the oxides of nitrogen emissions form subsonic and supersonic aircraft which is necessary to the improvement of the numerical models of the atmosphere used in assessing the long-term ozone distribution effects of aircraft, DOE shall provide the personnel, facilities, equipment and other materials necessary to perform the technical effort set forth.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

5.0036, NAVY ENVIRONMENT - SATELLITE ALTIMETRY
A. Gordon, Columbia University, Lamont Doherty Geological Observatory, *Palisades, New York* 10964 (DN875360; N00014-75-C-0210)

Remote sensing by satellite altimetry from SEASAT may offer a technique of determining the position of ocean tides, fronts, or eddies from the relative heights of the ocean surface. This technique is exploratory and depends on the accurate removal of gradetic features and resolution of the residual signature.

SEASAT A altimetry data from the northwest Atlantic will be collected and the calculated geared signature removed. The residual data will be analyzed for physical oceanographic features relating to frontal and eddy positions. The resulting analysis will be compared to surface measurements for ground truthing.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0037, SUNSPOTS
J.H. Thomas, University of Rochester, School of Engineering & Applied Science, Dept. of Aerospace & Mechanical Engineering, *260 Crittenden Blvd., Rochester, New York* 14627 (DF249000; F19628-77-C-0079)

AF function - communications, surveillance, detection, tracking. Deficiency - inadequate solar disturbance predictions. Objective -determine quantitative structure and dynamics of magnetic fields in solar sunspot regions. How research contributes - knowledge of solar magnetic field behavior is necessary to understand the role fields play in flare production.

Apply theoretical magnetohydrodynamics to observed motions and field configurations in sunspot umbrae and penumbrae. Such research will provide an insight into the physics of magnetic fields in spots and their impact on adjacent solar flare-producing plage regions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0038, NUMERICAL SIMULATION OF LARGE-SCALE OCEAN-ATMOSPHERE COUPLING AND THE OCEAN'S ROLE IN CLIMATE
W.L. Gates, Oregon State Higher Education System, Oregon State University, School of Science, Dept. of Atmospheric Science, *126 Agricultural Hall, Corvallis, Oregon* 97331 (NSG 5353)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0039, NONLINEAR TRANSFER OF KINETIC ENERGY IN THE ATMOSPHERE USING ONE- AND TWO-DIMENSIONAL SPECTRAL REPRESENTATION
D. Djuric, Texas A & M University, College Station Campus, School of Geosciences, Dept. of Meteorology, *College Station, Texas* 77843 (DF051280; AFOSR-78-3492)

AF function - the AF Global Weather Center uses a numerical model to forecast global meteorological conditions in support of AF operations. Deficiency - the physics of the atmospheric energetics are obscured by numerical techniques and limitations. Objective - to investigate the nonlinear transfer of kinetic energy for the Northern Hemisphere by two methods and determine if the forecast models are correctly handling this important parameter and if the one- and two-dimensional spectral repreions yield comparable results. Contribution -such spectral representations of dynamic models yield great insight into their representation of the physics and may be the future generation forecast model.

To use the spectral representation now available for the entire Northern Hemisphere and investigate the nonlinear transfer of kinetic energy. Both a one- and two-dimensional analyses will be used and a comparison of the two techniques made.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

5.0040, INVESTIGATION OF NEAR SURFACE AEROSOL PROPERTIES IN ARID REGIONS 15119-GS
J.M. Rosen, University of Wyoming, School of Arts & Sciences, Dept. of Physics & Astronomy, *P.O. Box 3435, University Station, Laramie, Wyoming* 82070 (DA0F9150; DAAG29-78-G-0048)

To develop a desert aerosol model capable of predicting vertical aerosol distribution from surface measurement of appropriate parameters. Relevance - this research is critical to the

Army Atmospheric Sciences Laboratory support of the tri-service high-energy laser program. The field measurements of aerosol will be taken near a high-energy laser test facility at White Sands Missile Range. There also is general relevance to any signal transfer in a slant-range mode.

Fine-scale vertical distribution of aerosol concentration in several size ranges will be obtained from a tethered balloon operating with a 10 kg payload to altitudes of 1700 feet. Concurrent vertical profiles of wind, temperature and humidity will be measured. This data will be used to develop the models outlined in the objective.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

5.0041, TRANSIONOSPHERIC PROPAGATION MIDDLE EAST

H.H. Hossinieh, Geophysics Inst., *Tehran, Iran* (DF268990; AFOSR-74-2673)

AF function - communications, radar and navigation. Deficiency or opportunity - lack of knowledge of the low-latitude ionosphere yields communications outages and navigation inaccuracies. Objective - the object of this research is to measure and catalogue ionospheric parameters over the Middle East. How research contributes - by measuring scintillation and electron content provides input data to a global ionospheric model used for navigation error and signal loss prediction.

The approach is to observe total electron content in the Middle East by polarimetry of signals from transmitting satellites.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, THE DEVELOPMENT OF AN AUTOMATED OBJECTIVE PERFORMANCE MEASUREMENT SYSTEM FOR ASUPT

W.L. Waag, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF221220)

The principal objective is the development of an automated objective performance measurement system to be used in training research employing ASUPT. Since positive transfer effects are assumed, it is possible to use measures of pilot performance in ASUPT as the criterion against which to evaluate alternative simulator hardware configurations and training strategies. A further objective is the development of an empirical data base reflecting performance standards of both experienced instructor pilots and students as they progress through the simulation training program. The scope of the effort is the development of measures for all flying phases of UPT which will be taught in ASUPT. The output will be a series of 'flying tests' directed toward the assessment of proficiency at various levels of training.

A criterion-referenced approach to pilot performance measurement has been adopted. It is assumed that superior maneuver performance manifests three characteristics: (1) accomplishing the criterion objectives as defined by the aircraft state parameters, (2) avoiding excessive rates and accelerations so that the maneuver is executed smoothly, and (3) accomplishing these objectives with the least amount of effort by minimizing control inputs. The development of the measurement system will require four phases: (1) definition of the criterion objectives for each maneuver in terms of a potential set of simulator parameters, (2) evaluation of the proposed set of measures for the purpose of validation and simplification, (3) specification of criterion performance by requiring experienced IPs to fly the maneuvers in question, and (4) the collection of normative data using students as they progress through the training program.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0002, CYTOFLUOROMETRIC ANALYSIS OF VIRAL INFECTION

W.J. Meinke, University of Arizona, School of Medicine, Dept. of Microbiology, *1501 N. Campbell Ave., Tucson, Arizona* 85721 (NSG 2381)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0003, MODELING THE EFFECTS OF ACCELERATION STRESS ON HUMAN OPERATOR PERFORMANCE IN AN AIR-TO-AIR TRACKING TASK

K.M. Kessler, Systems Control Inc., *260 Sheridan Ave., Palo Alto, California* 94306 (DF320780; F33615-77-C-0507)

A division requirement exists for a model of the human pilot tracking on a one-on-one, air-to-air engagement. Of particular interest is that the model reflect the effect of linear acceleration (g) and the effect of seat tilt back angle on the human tracker. TAC Avenger is a widely used air-to-air engagement model used by several Air Force organizations. It incorporates pilot decision logic to execute standard fighter tactics and determine realistic maneuvering flight paths. When the pilot decision logic establishes that one aircraft is in a missle-launch or gun-firing position against the other, the kill probability is computed by a separate appropriate subroutine. This subroutine, which is more detailed, can propagate the pilot tracking mean and covariance through the rest of the aircraft system, ballistics, and fly-out to establish the probability of kill for each gun-firing opportunity. This contract will be to develop and validate a human tracking model with which to modify the TAC Avenger tracking subroutine and answer the requirement for a TAC Avenger modification which reflects the effect of cumulative g loads on the pilot and the effect of seat back angle.

With the data produced by a series of experiments on the Dynamic Environment Simulator (DES) conducted by AMRL, the contractor will develop and validate a human tracking model responsive to the influences of g and seat back angles. The contractor will be involved in the discussions preceding an experiment in order to assure that the data produced by the experiment will be optimally useful for the modeling requirements. It is anticipated that there will be one or two experiments conducted and that each of the experiments will in part, capture human tracking performance under g, with the influence of various seat back angles included. The output of the model will be the mean and covariance of the pilot tracking error as a function of seat tilt back angle (with respect to the g vector), the present g load factor, and the antecedent g load factor. This is the mathematical form that can be most easily incorporated into TAC Avenger. The product of this task will be the mathematical description including all of the initial conditions and parameter values which describe the human tracker in this experimental situation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0004, CMI/MSP SERVICE TEST

L.G. Harding, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Lowry Air Force Base, Denver, Colorado* 80230 (DF224130)

Participate in a comparative study designed to gather data regarding the contributions of computer support in administering and managing individualized instruction. The results of this effort will assist Air Training Command in making decisions regarding the operational implementation and expansion of computer-based instruction.

The study will investigate cost-effective trade-offs of the contributions of the computer to reductions in training time, student performance, manpower and management versus costs attributable to computer support. Two experimental groups will be used. The manual self-paced group (MSP) will be administered self-paced instruction without use of computer support. All administrative tasks (e.g., test scoring, managing students, etc.) will be accomplished manually. The computer-managed instruction (CMI) group will use the computer for all aspects of conducting training. Dependent variables will include student training time, manpower requirements, student performance, maintenance costs, attrition rates and student attitudes.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0005, AVIATION MULTITASK INFORMATION PROCESSING MEASUREMENT

J.M. Owens, U.S. Dept. of Defense, Navy, Naval Aerospace Medical Research Lab., Aerospace Psychology Dept., *Pensacola, Florida* 32512 (DN677133)

The limited nature of man's information processing capacity coupled with the increasingly complex and demanding task environment of the naval aviator have critical implications for the safe and efficient design and operation of modern aviation systems. Future improvements of total systems efficiency and effectiveness are dependent upon the development of better techniques for specifying and measuring the quality of human performance in complex systems. This project is aimed toward the systematic development of a methodology for measuring and assessing concurrent multitask performance in aviation-relevant task situations.

The present approach utilizes a dedicated, high-speed computer and state-of-the-art display and control technology to uniquely configure tasking situations which simulates the information processing demands of actual aircrew tasks. The integrated performance measurement system combines a host computer with a flexible graphics processor and voice recognition and synthesis (VRAS) system to allow performance assessments in task environments relevant to current and emerging cockpit designs. In order to obtain improve measurements and assessments of the capacities and limitations of operators in complex, high-demand multitask situations, adaptive task loading techniques are selectively employed. These performance measurement techniques take into account the differences the initial individual skill levels and dynamically alter multiple task demands in real-time as a function of the operator's immediate past history of performance in the total tasking system.

SUPPORTED BY U.S. Dept. of Defense, Naval Medical Research & Development Command, National Naval Medical Center

6.0006, IMPROVED PRODUCTIVITY THROUGH USE OF INTRINSIC REWARDS

R.D. Pritchard, Purdue University, Purdue Research Foundation, *Life Sciences Bldg., West Lafayette, Indiana* 47907 (DF232950; F33615-77-C-0026)

To develop operationally feasible techniques for enhancing airmen productivity. These techniques will concentrate on increasing the job incumbent's motivation to perform through intrinsic motivation procedures applied at the level of the first-line supervisor. The end product of this work unit will be a comprehensive plan for a field test of the techniques developed.

The most critical determinants of intrinsic motivation which have potential for application in an Air Force operational environment will be identified. A test of the significance of these determinants will be conducted in a laboratory setting test using objective performance and job attitude criteria. Results of the laboratory test will be used to develop a detailed research plan for an Air Force operational environment field test of techniques for enhancing airmen productivity. Milestones for this work unit are as follows: 1 Oct-31 Oct 76--identify determinants of intrinsic motivation to be controlled or manipulated in the laboratory experimental tests; 1 Nov-31 Jan 77--design the actual experiments to test variables selected in step 1; 1 Feb 77-31 Jul 77--develop necessary work sample materials and conduct experiments; 1 Aug-30 Sep 77--develop a field-test plan to improve airmen productivity in an operational Air Force setting; 1 Oct 77-31 Dec 77--finalize technical reports.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0007, PRODUCTION OF MONOCLONAL ANTIBODIES TO HUMAN T-CELLS

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0008, COMPUTER-BASED INTERACTIVE FLIGHT TRAINING

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AF function - this research impacts future AF aircrew training programs. Deficiency - continued flying hour curtailments and projected restrictions on aircrew training as we know it today require the development of innovative training technologies for the future. Better performance measurement algorithms are needed and more optimal use of computer-based training for transition and continuation training programs in flight simulators is required. Objective - this research will investigate computer implemented algorithms as a new approach to flight performance analyses expressely designed for interactive application in computer-based simulators. How research contributes -more effective aircrew training in flight simulation devices should occur as a result of this research.

This research employs state-of-the-art semantic representation and pattern recognition methods for extracting significant features of task performance by the aircrew member. Knowledge of the methods used by expert instructors in analyzing task performance and malperformance behaviors will be used in procedures for parsing flights, defining segments and transitions, recognizing and characterizing errors and error patterns, diagnosing underlying trainee difficulties, and prescribing remedial training tasks to overcome task difficulties. The Orly simulator will be used for data collection from expert instructors. Instructor models will be created to determine ways of generating diagnostic and prescriptive procedures for the trainee.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0009, A FOUNDATION FOR SYSTEMS ANTHROPOMETRY

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AF function - in day-to-day operations, aircrew members are exposed to a number of dynamic situations such as being subjected to maneuvering forces (g), buffeting, and vibration. A new anthropometry which takes into account such dynamics in the design and operation of crew stations is required. Deficiency - conventional anthropometry provides static dimensions measured on subjects rigidly posed in highly standardized positions, and does not meet requirements for describing body motions in dynamic situations. Objective - a three-dimensional systems anthropometry will be developed which treats the body as a dynamic system. The model will optimize the number of links needed for description of body movement and mobility for workspace design and acceleration/deceleration simulations. How research contributes - the lack of such an anthropometric system is a significant roadblock to providing criteria central to the design of sophisticated human analogs, both physical and mathematical. This basic human engineering research program will lay the required foundation for using new anthropometric systems which are in sight in the near future.

A means of spatially identifying anatomical and anthropometric landmarks suitable for three-dimensional coordinate description will be developed. Procedures are being developed specifically to define external morphology, internal skeletal geometry and coordinate systems, and also provide a means of relating the new anthropomechanic data to the extant classical anthropometric data. Phase II will provide the methodology necessary to describe the human anthropomechanic system for one body region--the lumbar/pelvic/femur linkage system. Joint centers of mobility in the thoracic/lumbar linkage system will be studied during Phase III in preparation for the major task of relating the shoulder to the hip during Phase IV. In addition, differences in body size and differences within the same individual will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0010, PHYLOGENY OF PHOTOSYNTHETIC BACTERIA
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SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

6.0011, VESTIBULOCOLLIC REFLEXES OF OTOLITH ORIGIN
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SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0012, INVESTIGATION OF RELATIONSHIPS BETWEEN CREW RESTRAINT DESIGN CRITERIA AND IMPACT INJURIES
C.F. Acevedo, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF322360)

USAF accident investigations reveal that major injuries and fatalities may be related to the ineffectiveness of the personnel restraint systems under emergency escape or aircraft crash conditions. For example, operational statistics and aeromedical analysis have shown that the high spinal fracture rate (42 percent) occurring during use of the F-111 crew escape module is probably related to the geometry of the restraint system and ballistic inertia reel. Although design criteria are available they are often disregarded since their relationships to crew injuries are seldom quantified. The objective of this research effort is to determine the injury pathology associated with a specific impact protection system's design criteria. These criteria pertain to restraint system geometry, restraint tie-down points, webbing materials properties, load distribution and integral impact attenuation.

The injury potential associated with specific restraint systems will be experimentally evaluated using a subhuman primate. A baseline for comparative evaluation of protection systems will be established by conducting impact tests using the standard USAF lap belt and shoulder harness geometry published in current design specification handbooks. Impact injury pathology will be assessed using the AMA abbreviated injury severity index. Other restraint systems that are operational or in the conceptual design phase will be similarly tested to identify unique injury modes and to compare the severity of the observed injuries with those of the baseline protection configuration. Data collected under this work unit will also be used to provide methods for predicting impact injury severity using mathematical models.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0013, CREW SAFETY ASSESSMENT FOR AIR COMBAT FIGHTER (F-16)
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The F-16 aircraft incorporates new crew station design innovations to improve pilot performance under combat conditions. These innovations include an ejection seat reclined at 30 degrees back angle to improve performance under high maneuvering acceleration and a polycarbonate canopy without a conventional windshield structure. The canopy does not obstruct the pilot's vision in the area forward of the ejection seat headrest. The objective of this effort is to evaluate the performance of the F-16 ejection seat by review of rocket sled test data and to evaluate the crew injury potential associated with bird impact on the aircraft canopy. Assessment of the effects of inadvertent canopy loss on the pilot's ability to control the aircraft or initiate ejection is studied under work unit 72310655.

Assistance will be provided in preparation of a test plan for demonstration tests of the S111S-3 ejection seat using the rocket sled at Holloman AFB. Consultation will be provided on development of test data processing. Acceleration data recorded during the ejection tests will be analyzed to determine compliance with the acceleration limit criteria that has been provided in MIL-S-9479B. A test plan will be developed to evaluate the F-16 canopy's bird-strike protection capabilities. Impact exposure criteria will be developed using available biotechnology data. A special test rig will be designed and fabricated to measure the forces and moments acting on a helmeted headform during bird-strike tests at the Arnold Engineering Development Center. The testing and data analysis will be accomplished under a memorandum of agreement between the Air Force Flight Dynamics Laboratory, the Materials Laboratory, the Aerospace Medical Division and the F-16 System Program Office.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0014, CONSULTATION ON TOXIC ECOLOGICAL EFFECTS AND ENVIRONMENTAL IMPACT
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The objectives of this effort are: (1) to assist users of Air Force chemicals with interpretation of data related to the ecological aspects of their operations, (2) to lend technical assistance and provide professional advice to organizations preparing environmental impact statements or assessments, (3) to assist the surgeon general in responding to requests for review of criteria documents from NIOSH and EPA, and (4) to maintain contact with academic institutions, industry, and other governmental agencies in order to keep abreast of the state of the art in environmental research.

To provide technical and professional advice to any Air Force organization preparing environmental impact statements or assessments when chemical pollution is a major concern. Close liaison will be maintained with EPA to keep abreast of environmental quality standards and criteria requirements. When the National Academy of Sciences establishes its board on environmental quality, continuous contact will be established for assistance in setting environmental quality standards.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0015, DEVELOPMENT OF MODEL FOR THORACIC DYNAMICS
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Prediction of the mechanical response of the human thorax, and corresponding probabilities of injury occurrence resulting from direct impacts or variable high-amplitude air pressure exposures are required for the formulation of criteria for the design of manned flight systems. This effort will provide an analytic computer-based model for relating external body exposure parameters to the resulting dynamic response of the human chest wall, intrathoracic volume, thoracic overpressures and flow of respiratory gases through the trachea. These model responses will, in turn, be used in generating injury probabilities for prescribed exposure events.

The modeling approach used will account for the motion of the chest wall, the visceral contents below the diaphragm, the intrathoracic volume and the flow of respiratory gases through the trachea. Linear, and where necessary nonlinear, elastic properties will be used for coupling of the chest wall and visceral mass to the thoracic structure. Internal coupling resulting from pressure variations within the thoracic cavity will be considered for both adiabatic and isothermal processes. Resistance to flow through the trachea will be modeled for both the laminar (slow flow) and turbulent (fast flow) cases. Injury criteria will be developed by correlating response parameters to injury incidence and severity as observed in experiments reported in literature.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0016, VOICE COMMAND SWITCHING

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Human factors research has been involved with the efficient use of man's visual, auditory, and coordinated motor skill in crew stations. Increases in demands upon the eye/hand workload in crew stations leads to investigation of other means to carry out that function. A potential method for accomplishing the functions heretofore defined as eye/hand, is the use of voice-actuated switching or input coupled with voice feedback for verification. Development of voice or speech recognizers and synthesizers now permit them to be considered for switching systems. The use of the voice recognition and synthesis systems to control the B-52 EWO electronically steerable antenna system (ESAS) after failure of its automatic driving capability will be investigated. Successful application of these voice systems may directly enhance the mission success.

An interface of the ESAS drive system will be accomplished in the EW simulator. Mission requirements, tasks, and scenario will be developed to allow the EWO to maintain antenna tracking through verbal commands while accomplishing his other EWO tasks. Comparison of the operator's accuracy and time to perform these duties with and without the voice command system will be evaluated. Acquisition of the voice synthesizer, interfacing of the recognizer after ESAS installation, vocabulary selection and command structure all impact scheduling. All but the actual tie to the SW simulator can be initiated immediately. January 1977 is the projected date for system checkout and scheduling.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0017, MILITARY SPECS AND STANDARDS

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There are two objectives: (1) to provide human engineering application, support and consultation at any and all stages of development - initial conception, concept evaluation, conceptual design, formulation, acquisition, testing, trouble shooting, and maintenance of systems and subsystems, and (2) to collect human factors research data and convert it into forms such as specifications, standards and handbooks that are directly usable by weapons system management and design personnel.

A diversified group of human factors specialists is maintained to respond to requests for assistance from AF, other government organizations, industry, and allied forces. The group assists in formulating the problem and makes recommendations for equipment design and for airborne and laboratory procedures, tests and evaluations, literature searches, data collection, and in-house and contract research programs. As requests for this HE expertise are received, the effort is recorded under this work unit until such time as the effort is sufficiently large to require its own documentation. This work unit provides human engineering participation to the (1) AFSC Human Engineering Panel, (2) revision of Human Engineering Specs and Standards, MIL-H-46855 and MIL-STD-1472 respectively, (3) revision of DH1-3, human factors engineering, and (4) aircrew station standardization panel. The results of the above efforts are utilized throughout the Air Force in the development of Air Force systems and equipment by incorporating them in contractual documents. In addition, MIL-H-46855 and MIL-STD-1472 are coordinated and used by all three services.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0018, DEVELOP NOISEFILE 2 AND EXPAND/UPDATE NOISE DATA HANDBOOK TO DEFINE AIR-BASE/COMMUNITY NOISE

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The AMRL NOISEFILE (developed under work unit 72310425) contains the aircraft flight and ground runup noise data required as input to the NOISEMAP Environmental Noise Exposure Predictive Program. The USAF Noise Data Handbook (developed under 72310418) includes the data needed by bioenvironmental and civil engineers for defining/resolving on-base and surrounding community noise problems from ground runup operations. It is essential that both NOISEFILE and the Noise Data Handbook be continuously expanded/updated to include data on aircraft currently in inventory as well as new systems as they are developed. This is critical for: (1) Air Staff/MAJCOM/SPO beddown/deployment, environmental noise impact, and compatible land use studies using the NOISEMAP computerized procedure, and (2) Airbase/MAJCOM local facility siting and ground runup noise assessment studies using the Noise Data Handbook.

Instrumentation, test protocols, and data reduction techniques previously developed by AMRL will be used to maintain continuity with the prior data acquired and analyzed on over 40 aircraft.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0019, RESEARCH ON LIMB FLAIL DESIGN LIMITS

E. Grood, University of Cincinnati, Graduate School, *305 Physics Bldg., Cincinnati, Ohio* 45221 (DF319910; F33615-76-C-0511)

Design criteria are required to define the tolerance of the human body to the aerodynamic forces encountered during emergency escape from high-speed aircraft. Limb flail injuries represent a major cause of injuries resulting from use of ejection seats. The objective of this effort is to initiate the definition of the tolerance and failure limits of the musculoskeletal system of the human leg, specifically the knee joint, to high mechanical stress conditions such as occur in emergency egress, windblast conditions and hard or impact landings.

Components of the human knee joint, specifically the femur-anterior cruciate ligament-tibia system will be tested in translational extension at high strain rates and the results compared with rhesus monkey results previously obtained (AMRL-TR-73-117). The response and failure limits of the intact human knee to rapid rotation (tibia rotation relative to the femur) will also be determined. Special emphasis will be given to the selection, preparation, and mounting of specimens to assure optimal simulation of the live, healthy human leg.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0020, FLYING TRAINING RESEARCH SUPPORT SERVICES

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(1) To obtain quick response flying training research products through a university-based contract which utilizes Air Force Human Resources Laboratory (AFHRL), Flying Training Research Division (FT) research facilities and/or the facilities of the university itself. (2) To provide expert outside consultation to AFHRL/FT personnel concerning selected flying training problem areas.

The multidisplinary capabilities of a university will be used to obtain flying training research on a number of high-impact research questions. The research requirements for each research project will be designed to allow full autonomy of contractor effort. On an as-required basis, university consultants will also be utilized to update or augment AFHRL/FT staff knowledge concerning critical research topics.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0021, RESCUE AND RECOVERY EQUIPMENT

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To test and evaluate newly developed commercial or in-house items of medical material to determine their effectiveness in the Aerospace Rescue and Recovery Service (ARRS) medical missions. The Biomedical Systems Branch has an ongoing pro-

gram to evaluate medical material items to satisfy identified operational requirements for the ARRS. Performance criteria have been established to insure that medical equipment items meet stated operational requirements of the mission. Current state-of-the-art medical material technology will be continually assessed.

The test program normally consists of six major areas: patient/user safety, operational specifications, environmental effects, electrical and mechanical characteristics, and human factors. Each area is subdivided into specific engineering tests or evaluations. Upon completion of the test program, a written report stating whether the item is or can be made acceptable is sent to the field. The information is kept on file and is updated or modified as user reports are recieved. This is a continuation of part of the work formerly documented under 7755-15-02.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0022, SIGNIFICANCE OF ARTERIOGRAPHIC MINIMAL CORONARY ATHEROSCLEROTIC HEART DISEASE IN THE AIRCREW MEMBER

R. Anthracite, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF321920)

Minimize the number of flyers who must be grounded because of the presence of minimal coronary artery disease that is functionally insignificant, establish techniques to detect disease progression/regression, evaluate the effect of risk factor modification on the progression of the disease, and establish the significance of given lesions on long-term prognosis for the purpose of establishing retention criteria.

Aircrew members identified as having minimal coronary atherosclerotic heart disease (i.e., a degree of obstruction associated with a coronary event rate that is no greater than that observed in an apparently healthy similar aged population not subjected to cardiac catheterization) will be followed longitudinally with serial risk factor assessment, noninvasive tests (e.g., exercise stress testing) and coronary arteriography to establish significance of given lesions and the influence of risk factor modification on disease progression. Newer noninvasive techniques used to assess the functional capacity of the coronary circulation will be correlated with the results of cardiac catheterization in an attempt to reduce the frequency of the latter procedure at no expense to flying safety and mission completion.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0023, EEG ABNORMALITIES AND NEUROLOGIC SEQUELAE

A.C. Gigliotti, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF321700)

The objective is to refine the definition of normal/abnormal states and apply these data to flying personnel on a short and prolonged basis. Certain electroencephalographic phemonema seem correlated with clinical conditions and occur after such events as head trauma. But the meaning of these findings in asymptomatic individuals with no relevant history and normal physical findings is uncertain. Long-term followup of a group of subjects with these findings is indicated in order to study the meaning of these EEG phenomena in otherwise normal individuals.

All aircrews undergoing evaluation by the Aeromedical Consultation Service routinely have electroencephalography with hyperventilation and photic drive. Additionally, sleep-deprived EEGs are obtained if there is any evidence of abnormality which is not clearly disqualifying for flying duties. EEGs are interpreted in accordance with Air Force aircrew standards and those subjects not meeting those standards are disqualified for flying duties. All of the last 100 such EEGs will be reviewed by the primary investigator for accuracy of interpretation. An attempt to reach the subjects involved will be made by mailing them questionnaires to assess their current clinical status and job experience. Similar questionnaires will be mailed to a matched group with normal EEGs. Data will be analyzed to differentiate those findings which are predictive of disability for flying duty. This effort was formerly documented under work unit 7755-04-08.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0024, EMERGENCY BREATHING SYSTEMS

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Develop, test and evaluate emergency oxygen and air breathing supply systems for use in aircraft, missile and other essential Air Force applications. The requirements for this work come from the ASD, AFLC (OC-ALC) and MAC. The work is coordinated with the ASD/AEL, EN, USN, and USAARL.

Current requirements include an extensive test program to establish definitive duration limits for the MA-1 portable oxygen system. This effort was requested by Oklahoma City ALC due to inconsistencies in USAF technical orders. Respiratory ventilation requirements of loadmasters and navigators will be measured inflight on cargo aircraft, using the inflight physiologic data acquisition system developed at USAFSAM. An additional ongoing effort in response to a request from ASD/ENEC is to assess the physiologic adequacy of the standard H-2 emergency cylinder, or bailout bottle, as an emergency oxygen supply for C-130 passengers. Tests are being performed using both the standard USAF MBU-5/P mask and the continuous flow disposable passenger mask. When required, tests will be performed under simulated operational conditions using an oxygen regulator test stand, altitude chamber and human exercise treadmill if necessary.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0025, RADIOFREQUENCY RADIATION EFFECTS ON BIOCHEMICAL SYSTEMS IN THE CENTRAL NERVOUS SYSTEM

J.H. Merritt, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF318800)

The Department of Defense Triservice Electromagnetic Radiation (EMR) Bioeffects Research Program describes the central nervous system (CNS) as the 'singularly most important area where there is evidence that EMR interacts with biological systems.' The objective of this effort is to quantitate the radiofrequency (RF) EMR effects on biochemical events subserving nerve transmission in the CNS. The information obtained will be applied to establish more appropriate safety standards for personnel working in close proximity to AF RF emitters.

The effects of RF radiation on the CNS, specifically on a specialized function of the neuron, namely synaptic transmission, will be studied. It is probably true to say that every cell in the brain is connected, directly or indirectly, to every other cell by chemical switching systems (synaptic transmission). This effort will attempt to quantify changes produced by RF energy in these chemical systems, determine thresholds for frequency and power density, and interpret these changes in terms of the expected effect on man in AF operational environments.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0026, EFFECT OF CHEMICAL MUTAGENS ON HERPESVIRUS TRANSFORMATION AND BACKMUTATION OF THO CELLS

F.B. Johnson, Brigham Young University, School of Biological & Agricultural Sciences, Dept. of Microbiology, *B-166 A S B, Provo, Utah* 84601 (DF052360; AFOSR-78-3606)

AF function - the AF uses many unique chemicals and materials to obtain optimum performance of its aircraft and missile weapons systems. Strategic and tactical objectives call for the use of the most energetic compounds for ICBM and air-launch missiles. National legislative and regulatory controls on the use of energetic chemicals have necessitated a step-function increase in the need to define safe exposure limits and handling practices for these chemicals concurrent with the acquisition of the weapon system. Deficiency - a number of tests for mutagenesis exist in procaryotic cells. There is, however, a paucity of information on sensitive tests involving back-mutations in mammalian cells. Ob-

jective - selected AF chemicals will be tested for ability to cause enhanced oncogenesis of HSV-2 in Swiss 3T3 cells when the chemical exposure comes before the virus infestion, mutagenesis using the THO cell indicator system. How research contributes - this work directly supports related ongoing efforts at AMRL/TH dealing with the possible carcinogenicity of AF chemicals and materials, and contributes to Subarea 1.9, 'Environmental Protection and Toxicological Hazards.'

Swiss 3T3 cell-herpesvirus type 2 model will be used to measure viral transformation in the presence of mutagenic chemicals. Previous work involved the exposure of the virus-infected cell to chemical mutagens. These data will be confirmed and extended to include analysis on the effects on viral transformation of prior exposure to the chemicals. Chemicals will be tested for mutagenesis in THO cells and compared with the results of published information obtained by other procedures. The compounds to be tested are n,nitrosodimethylamine, 1,2-dimethylhydrazine, hydrazine, methylhydrazine, 1,1-dimethylhydrazine, JP-5, JP-10, RJ-4 and RJ-5.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0027, AN EXAMINATION OF THE CLINOSTAT PROBLEM USING LEAFY PLANTS

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, AIRSPACE SIMULATION COMPUTER MODEL

Unknown, Aerospace Corp., *P.O. Box 95085, Los Angeles, California* 90045 (FA78WAI-921; FA161483 (TRAIS NO.))

The study is designed to demonstrate how closely the model performance compares with real world activity in the terminal area airspace and how capable it is for purposes of conducting terminal area airspace delay simulation studies. The airspace simulation computer model is to be further developed to meet the scientific and engineering technical needs of the FAA in studying airspace problems. The applicability of the model will be tested and demonstrated on a selected major hub airspace situation. The final version of the model will be installed on the DOT Time-Share Computer Facility upon completion of this effort.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

7.0002, APPROXIMATION THEORY - COMPUTATIONAL APPROXIMATIONS, APPROXIMATION WITH SIDE CONDITIONS AND APPLICATIONS

G.D. Taylor, Colorado State University, School of Arts Humanities & Social Sciences, Dept. of Mathematics, *Fort Collins, Colorado* 80523 (DF041210; AFOSR-76-2878)

AF function - the design of structural components for aerospace vehicles. Opportunity - rational approximations techniques are very effective in the solution of applicable problems of interest to the Air Force. Objective - this effort will investigate rational approximations, approximation with side conditions and application of the theory to application problems. How work contributes - computational techniques may be developed for solving problems which cannot be effectively solved with available methods.

This research effort will involve the calculation of good approximations in the uniform norm which can be generalized to functions in several variables and to approximations with side conditions. Efforts will include approximation of exp (-x) to construct numerical methods for solving linear parabolic partial differential equations. Application of approximation theory with side conditions in designing non-recursive digital filters will be investigated. The uniqueness and error of approximation of linear approximations with side conditions will also be studied. Efforts will be spent to develop various curve fitting routines that make use of uniform approximation theory with side conditions. The long-range goal is to develop some viable adaptive fitting routines for problems in several variables using uniform approximation theory.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0003, CONCURRENT PROCESSING SYSTEMS STUDY

T.Y. Feng, Wayne State University, School of Engineering, Dept. of Electrical & Computer Engineering, *5950 Cass Ave., Detroit, Michigan* 48202 (DF728230; F30602-76-C-0282)

The objective of this effort is to conduct exploratory development in the design and use of concurrent processing systems for Air Force data processing needs. Four broad areas of computing technology are to be emphasized, configuration systems, programming languages, modeling and performance evaluation, and design specification languages.

To investigate and develop techniques and procedures for grouping microprocessors and develop program routines which will cause these groups to act as a variety of functional units (ALU, push down stack, index register, etc.). Using the features of the data manipulator and the STARAN associative processor develop techniques for interconnecting the functional units to form concurrent computer architectures. Using the features of the Nanodata QM-1 develop specification and compiler techniques for controlling all elements of the above system such that a user's HOL description of a problem solution and an architecture specification can be entered into the system and the problem then executed as if it were on the specified architecture. Using the elements of the system, develop techniques for performance monitoring. Develop concurrent processor application programs. A solid background in parallel processor system and in the development of parallel processor algorithms is required.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

7.0004, THE CONSTRAINT METHOD FOR SOLID FINITE ELEMENTS

I.N. Katz, Washington University, School of Arts & Sciences, Dept. of Systems Science & Mathematics, *4559 Scott Ave., St. Louis, Missouri* 63130 (DF046190; AFOSR-77-3122)

AF function - the design of future aerospace vehicles. Opportunity - new techniques which allow control of the order of approximating polynomials and the number of elements in each division of 2D finite-element stress analysis are presently available. The use of those techniques in the development of computational codes may be very useful in the design of structures for aerospace vehicles. Objective - to continue the investigation in the development of the constraint methods for three-dimensional finite elements. How work contributes - techniques to be developed under this effort will be useful to engineers at the AFFDL.

With availability of the newly developed hierarchical families of solid finite elements permitting increase of polynomial order without recomputation of lower-order terms the focus of the research now shifts from development of the elemental level to global and algorithmic considerations. These include efficient computational solution of the global (assembled) systems, error estimates leading to self-adaptiveness, and algorithms for efficient implementation on digital computers. Also the research will include formulation of a pyramidal element and elements with curved sides.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0005, NAVIER-STOKES NUMERICAL METHODS FOR CALCULATING HIGH REYNOLDS NUMBER SEPARATED FLOWS

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The effectiveness of aircraft, whether conventional or V/STOL, at low speeds is reduced by flow separation. The separation is caused by adverse pressure gradients induced by, for example, deflected control surfaces, high incidence angles of the wings, or deflected jets. This research is a numerical approach, within the framework of the Navier-Stokes equations, for the development of a methodology to calculate low-speed separated flows with particular emphasis on high Reynolds numbers.

Flow separation at low speeds is an extremely complex phenomenon which can, at this time, be described in general only by detailed and tedious experiments or possibly by numerical calculations for an extremely limited set of special cases. Separation is beyond the scope of conventional boundary layer theory, and hence predictive procedures must rely on phenomenological modeling, higher order approximations, or numerical solutions of the Navier-Stokes equations. For high Reynolds number separated flows, special techniques must be developed for solving the Navier-Stokes equations such that the truncation errors in the convective terms do not swamp the complete viscous terms. This research will study the application of spectral methods to such problems, paying attention to the development of techniques for handling non-periodic data domains in periodic fashion with a finite number of continuous space derivatives at the boundaries. The periodic treatment is important from the viewpoint of developing a general methodology for broad classes of flow problems.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

7.0006, LANGUAGES FOR COORDINATION AND CONTROL OF CONCURRENT AND DISTRIBUTED PROCESSING IN IMBEDDED AVIONICS AND SPACE APPLICATIONS (ABBREV)

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

7.0007, USE OF WAGNER FUNCTIONS IN AIRFOIL DESIGN OPTIMIZATION

V. Sahai, State University & Community College System of Tennessee, Tennessee Technological University, School of Engineering, Dept. of Engineering Science & Mechanics, *P.O. Box 128A, Cookeville, Tennessee* 38501 (051560; AFOSR-78-3543)

AF function - advanced aerospace vehicles. Opportunity -improvement of numerical methods used in the design of optimized wing sections. Objective - test the suitability of using a mathematical description of airfoil contours based on Wagner functions in a constrained airfoil design optimization computer code. How work contributes - will determine the potential usefulness of a particular functional representation for airfoil geometry applied in a numerical optimization procedure. The advantage of the functional representation in this application is the promise of generating a wide class of shapes in terms of a small number of parameters.

The properties of the Wagner functions will be examined in terms of their ability to generate a wide class of airfoil shapes. Their behavior and relationship to trailing edge slope, nose shape, and other airfoil characteristics will also be studied. The proposed functional relationship will be used in a vanderPlaats-Hicks-type numerical optimization code to design a symmetrical airfoil.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, NUMERICAL STUDIES OF MAGNETOHYDRODYNAMIC PROCESSES IN SPACE

J.M. Dawson, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (ATM7819253)

Using computer codes developed for laboratory plasma studies, the University of California at Los Angeles magnetospheric physicists plan to model the dynamic aspects of the earth's magnetic field. In particular, the following studies will be undertaken: (1) Dependence of the global structure of the magnetosphere on solar wind parameters. The steady-state structure of the magnetosphere will be studied as a function of solar wind velocity, pressure, and magnetic field magnitude and direction. (2) Global response of the magnetosphere to the time dependent solar wind. If time permits, the following will be attempted: (3) Study of magnetic reconnection in the earth's magnetosphere. (4) Kelvin-Helmholtz instability in a realistic magnetosphere. The overall aim is to study magnetospheric dynamics using the computer.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

8.0002, TRANSPORT AND ELECTRONIC PROPERTIES OF DISORDERED SOLIDS

M. Pollak, University of California, Riverside Campus, School of Physical Sciences, Dept. of Physics, *Riverside, California* 92502 (DMR7821959)

Transport and electronic properties of disordered solids will be investigated in two fundamental areas: one, the existence of a Hall effect associated with the hopping conduction process, and the other, the role of interactions in the electronic and transport properties of disordered systems. The Hall effect is primarily an experimental effort to measure the dependence of the AC Hall effect on the various relevant parameters. Theoretical work on the DC Hall effect associated with hopping, a strictly quantum mechanical process of fundamental interest, will also be performed. The work on interaction effects include an experimental and a theoretical part. The experimental part is done with the impurity conduction system (p-Ge), both because such effects are believed to be pronounced and because it is possible to vary some important parameters; namely, the concentration and the size and shape of the wave function. The theoretical work involves mainly three problems: the Coulomb gap for one electron hopping excitations and its effect on transport, the role of multi-electron excitations in transport, and a new problem of collective delocalization. This is the first year of a three-year continuing grant.

Reference: DMR77-22500.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0003, THEORY OF SOLIDS

W. Kohn, University of California, San Diego Campus, Graduate School, Dept. of Physics, *P.O. Box 109, La Jolla, California* 92037 (DMR7825005)

Research previously supported by DMR7682422.

Research in the theory of solids will be carried out. The main emphasis will be on surface phenomena, including: (a) dynamics of electrons near metal surfaces, especially the high density limit of the work function; (b) scattering of positrons from metal surfaces; and (c) implications of bulk phonon spectra.

Other subjects to be studied include the following: density-density response functions in inhomogeneous systems with applications to non-local energy corrections of density function l theory; a new formulation of local theory of electronic structure allowing the calculation of local properties of an extended system without having to deal with the entire system; and theoretical studies, related in part to ongoing experimental programs of optical systems, for efficient conversion of solar radiation into heat.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0004, COMMUNICATIONS - SOLAR RADIATIONS IN NEAR SPACE AND THEIR EFFECTS ON THE EARTH'S MAGNETOSPHERE AND IONOSPHERE

J.A. VanAllen, University of Iowa, School of Liberal Arts, Dept. of Physics, *Jessup Hall, Iowa City, Iowa* 52240 (DN624361; N00014-76-C-0016)

The performance of all long-range naval radio communications, radar, and navigation systems is degraded or disrupted by ionospheric disturbances of magnetospheric or solar origin. The objective of this program is to develop an improved understanding of the energetic particles, electric, magnetic, and electromagnetic fields in the earth's ionosphere and magnetosphere, the sun, and the interplanetary medium, and their interactions, in order to determine the causes of the ionospheric disturbances. The causal factors must be determined to provide accurate forecasts of the disturbances, and their disruptive effects.

Energetic particle and field data is taken with a variety of satellite experiments, support by ground-based radio and optical measurements, and theoretical plasma physics research.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0005, DYNAMICAL SCALING IN NORMAL AND SUPERFLUID LIQUIDS

R.A. Ferrell, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics, *College Park, Maryland* 20742 (DMR7901172)

Research previously supported by DMR7414372.

Theoretical research on the critical dynamics of normal and superfluid liquids will be carried out. Particular emphasis will be placed on the lambda transition of liquid helium, in order to exploit recent developments on this problem. Further details of the light scattering spectra and critical region will be studied. A thorough exploration of the critical dynamics of the ordered state of helium will be undertaken. Also, some higher order calculations on the binary liquid problem will be completed, in order to interpret some of the data generated by the University of Maryland experimental phase transition group. Special attention will be given to the nature of spinodal decomposition in a two-component fluid.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0006, PREPARATION AND CHARACTERIZATION OF IMPROVED SUPERCONDUCTING MATERIALS

J. Bevk, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Applied Physics, *Cambridge Station, Cambridge, Massachusetts* 02138 (DMR7905011)

The objective of this work is to study the formation and superconducting behavior of various binary and pseudo-binary A-15 compounds prepared by new techniques such as liquid-quenching and in situ composite formation. The program will have three main parts: (1) Manipulation of microstructure of crystalline binary and pseudobinary A-15 compounds by controlled quenching from the liquid state and subsequent study of critical currents and flux-pinning mechanisms. (2) Preparation of compositionally and/or structually metastable A-15 compounds. (3) Study of superconducting properties of materials derived from transformation of amorphous alloys.

In addition the transport properties and mechanical behavior of the in situ multifilamentary composites of copper-niobium and copper-Nb-Sn will be determined. Theoretical analysis and modeling will include examination of the field effect on the superconducting volume fraction and the analysis of materials which are expected to follow a 2- or 3-dimensional behavior.

This work is a continuation of studies initiated under NSF Grant DMR74-22263A01, and is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0007, CORONAL PLASMA PROCESSES - HEATING AND ENERGETIC BALANCE OF CLOSED CORONAL STRUCTURES

G.S. Vaiana, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Astronomy, *Cambridge Station, Cambridge, Massachusetts* 02138 (NSG 7537)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

8.0008, LASER AND OPTICAL PHYSICS 13410-P

M. Lax, City University of New York, City College, School of Liberal Arts & Sciences, Dept. of Physics, *Convent Ave. & 138th St., New York, New York* 10031 (DA0U5578; DAAG29 76 G0055)

To study (1) linear and nonlinear interaction of electromagnetic radiation with electric and magnetic polarization carrying excitations in condensed matter, (2) fluctuations in lasers and condensed matter including hydrodynamic instabilities, and (3) laser physics, including laser resonators, mode competition, light amplification. The use of interdependences between pyro, piezo, magneto, and electrooptic properties of materials forms the basis for a part of electronic device technologies. The laser work is relevant to the design of high-power lasers that are desired to operate in a single longitudinal mode to obtain a powerful, narrowly focused beam. The Bernard instability finds application in cloud formation in meteorology and the Rayleigh-Taylor instability is applicable to lubrication and flow over curved surfaces.

(1) A unifying Lagrangian approach is used, for both dissipative and non-dissipative phenomena, emphasizing rotational and displacement invariance in addition to usual (e.g., crystalline) symmetries. (2) Using efficient methods of calculating correlation functions for Fokker-Planck systems, study the onset of Bernard and Rayleigh-Taylor instabilities and the onset of turbulence in laminar flows induced by thermal gradients and shear forces. (3) Corrections to the paraxial approximation to the Maxwell equations are obtained and used to investigate the effects of refraction, gain saturation and diffraction in laser amplifiers.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0009, NOVEL CHEMICAL LASER SYSTEMS

T.A. Cool, Cornell University, Ithaca Campus, School of Engineering, Dept. of Engineering & Applied Physics, *242 Carpenter Hall, Ithaca, New York* 14853 (DF047880; AFOSR-77-3258)

AF function - future Air Force operations in reconnaissance, communications, weaponry, and other areas require advances in laser systems of varied output frequencies and shorter wavelengths. Deficiency - there is a lack of a visible, chemically pumped efficient laser system to satisfy these functional requirements. Objective -perform research on metal atom plus oxidizer reactions to produce electronically excited states with chemiluminescence in the visible and ultraviolet. Evaluate the HCN system as a possible alternative to DF chemical laser operation. How work contributes - attempts to discover visible chemiluminescent reactions of high photon yield and long lifetime that can lead to the development of new chemical lasers.

Employ shock tube techniques to produce shock-induced supersonic flow for the production of electronically excited states of SCF and YCL by reactions of the metal vapors with the halogens. Measure spontaneous emission from these excited states and attempt to achieve laser operation. In a relatively smaller effort examine the feasibility of producing a CW chemical HCN laser at 3.85 microns by studying chemical reactions and molecular energy transfer in the systems H2-HCN, HF-HCN and DF-HCN.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0010, MICROWAVE REFLECTIONS FROM VIBRATING INHOMOGENEOUS CONDUCTING SURFACES

H.J. Juretschke, Polytechnic Inst. of New York, Brooklyn Campus, School of Science & Engineering, Dept. of Physics, *333 Jay St., Brooklyn, New York* 11201 (DF043910; AFOSR-76-3030)

AF function - identification and recognition of targets under all-weather and night conditions. Deficiency - effectiveness of strike capability is diminished by unreliable selection of moving targets. Objective - features of a target have to be determined and utilized which allow with high probability a unique and environment-independent identification. This research relates to the identification of moving vehicles on the basis of their radar backscatter characteristics which are caused by vibration of junctions of abutting metal parts, that is, to the problem of RADAM (radar detection of agitated metals). How work contributes - experimental and theoretical study of backscattering from time-variant metal-insulator-metal junctions.

The study of microwave properties of composite conducting surfaces such as represented by grainy oxide layers of iron or oxide layers in surface fissures as a model for the modulation of electromagnetic signals scattered from vibrating metallic surfaces will be continued. The work will concentrate on (a) the microwave response of surfaces prepared under controlled conditions and of surfaces aged in natural environments, (b) the strain sensitive electrical properties of thin layers that simulate on a macroscopic level the effect of junctions between metallic layers, (c) the development of a model of the electrical properties of such composite surfaces that permits predictions of the effect of changing frequency, clean surface substrate, and surface conditions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0011, CALCULATIONS OF SURFACE BINDING AND MOBILITY OF ADATOMS 14766-MS

H.B. Huntington, Rensselaer Polytechnic Inst., School of Science, Dept. of Physics & Astronomy, *110 8th, Troy, New York* 12181 (DA0F9179; DAAG29-78-G-0065)

To theoretically approach the surface binding and mobility of adatoms, taking into account the metal surface structure, driving force for electromigration, and the influence of the adatoms on the electronic work function of the metal in order to achieve a simplified model of adatom-surface interactions. Relevance - catalysis, corrosion, oxidation, chemical vapor deposition on surfaces, and degradation of stability in printed circuit components of electronic equipment.

Investigation of the surface problem of simple, nearly free electron metals using the density functional formalism. Investigate the implications of the revised kinetic energy model on the binding energies of various metals of different charge densities. Study of the influence of close packed and low density planes. Calculations modeling situations of movement of impurity atoms across a surface, and electromigration along a free surface.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0012, TURBULENCE AND STATISTICAL MECHANICS

R.J. Donnelly, Oregon State Higher Education System, University of Oregon, School of Liberal Arts, Dept. of Physics, *1472 Kincaid St., Eugene, Oregon* 97401 (DF041640; AFOSR-76-2880)

AF function - this proposed research primarily falls in the 4.2 and 5.3 research objectives which deal with the fundamental process of turbulence and cryogenic cooling of superconductive rotating electrical power generators and pulsed superconductive energy storage systems. Liquid helium is a system obeying a two fluid model having normal fluid and superfluid velocity fields. Motion in these fields may be laminar or turbulent. There is reason to think that turbulence in the superfluid will be qualitatively different than in the normal fluid because the vorticity obeys a quantum restriction. Deficiency - research is required on the fundamental process of turbulence and on the understanding of the mixing of two streams including the turbulence diffusion and dissipative mechanisms. Transition from laminar to turbulent flow is poorly understood and errors in transition location can greatly affect drag or high-speed thermal protection systems. Objective - the objective of this research is to develop a fundamental understanding of the properties of HeII. Measurements of quantum fluid turbulence parameters will aid in the development of the superfluid equations of motion which contain realistic properties such as quantized vortices, heating and relaxation effect. Contribution - this research is a part of a comprehensive program in low-temperature physics.

The study of the vortex line density profile for steady-state counterflow in the 40 cm channel will be completed. Included will be a determination of the temperature dependence of the profile from about 1.1 k to the critical temperature. Correlations between any temperature variations in the profile and the corresponding variations in the normal and superfluid velocity fields and densities may provide some valuable clues for understanding the observed inhomogeneities in the turbulence.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0013, NEUTRON DIFFRACTION STUDY OF ATOMIC AND SPIN CORRELATIONS IN AMORPHOUS RARE EARTH-TRANSITION METAL ALLOYS

S.S. Malik, University of Rhode Island, School of Arts & Sciences, Dept. of Physics, *Kingston, Rhode Island* 02881 (DMR7823650)

Theories of the magnetic behavior of amorphous alloys containing rare earth and iron series elements depend sensitively on atomic and magnetic structure, which is reflected in the pair correlation functions of atom positions and spin density. The dense random packing of hard spheres is generally accepted as the model best describing the atomic structure, but fine details are difficult to extract from conventional scattering measurements because of the binary and ternary nature of these alloys. Neutron scattering measurements will be made using different isotopes of dysprosium and iron in amorphous DyFe2 so that the pair correlations of the different atomic species can be determined. Once the model is confirmed in detail, or appropriate modifications made, an investigation will be undertaken to compare magnetic scattering with specific spin models in this and other appropriately chosen amorphous systems using computer simulation methods to generate the spin models. Spin correlations at longer range will also be investigated by small angle magnetic scattering in DyFe2 and GdFe2 to investigate the role of the rare earth orbital moment in the previously observed anomalies in the critical scattering. A study of the wave-vector and frequency dependence of the small angle scattering from GdAl3, which exhibits spin glass behavior will be carried out.

Reference: DMR-7522379.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0014, VEHICLE MOTION REQUIREMENTS FOR SCIENTIFIC EXPERIMENTS IN SPACE

B. Antar, University of Tennessee, Knoxville Campus, Graduate School, *W. Cumberland Ave. S.W., Knoxville, Tennessee* 37916 (NAS 8-33447)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Marshall Space Flight Center

8.0015, HIGH-ENERGY PHYSICS RESEARCH

L.W. Mo, Virginia Polytechnic Inst. & State University, School of Arts & Sciences, Dept. of Physics, *Blacksburg, Virginia* 24061 (PHY7727521A01)

This grant will support research in experimental elementary particle physics. The research will study important questions in weak and electromagnetic interactions. The main thrust of the research is to: 1. Study the purely leptonic elastic scattering reaction. It will contribute to a better understanding of weak interactions and provide precise tests for the validity of current theory. 2. Study production of prompt neutrinos at high energies in hadron collisions at FNAL. 3. Investigate future possibilities of electron-proton colliding beam physics at Fermilab.

This work is a continuation of that currently supported under NSF grant PHY77-27521.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, OPTICAL PHOTOMETRY AND POLARIMETRY AND CONFIRMED COUNTERPARTS FOR X-RAY BINARY PULSARS
S.F. Tapia, University of Arizona, Graduate School, *Tucson, Arizona* 85721 (NSG 7574)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0002, A COSMOLOGICAL STUDY OF VERY FAINT GALAXIES
J.B. Oke, California Inst. of Technology, Graduate School, Dept. of Astronomy, *1201 E. California Blvd., Pasadena, California* 91109 (AST7824842)

A number of related research projects will be carried out as follows: 1) The search for faint clusters of galaxies and photometry of these galaxies. This existing program will now emphasize finding clusters in the range of z from 0.6 to 0.8. This research is best done in the near infrared. 2) Structure and dynamics of elliptical galaxies. The major uncertainty in the Hubble diagram test for qo is the effect of dynamical evolution, which is strongly dependent on the distribution of mass in cluster ellipticals. Rotation and velocity dispersions in nearly elliptical galaxies are being studied in order to better understand the situation. 3) The bright end of the Hubble diagram. Earlier work on the Hubble diagram indicated that a significant part of the uncertainty in the results stemmed from lack of knowledge about the nearer clusters. A study of Abell clusters is being completed to remove these uncertainties. 4) Obtain energy distributions and redshifts of very distant clusters. The emphasis is on the most distant clusters discovered. The results will be used to further investigate the Hubble relation and evolutionary effects. The discovery of differences among first rank galaxies which is probably attributable to heavy element abundance variations will be studied in detail.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0003, SOLAR PHYSICS
K.B. Gebbie, U.S. Dept. of Commerce, National Bureau of Standards, *325 S. Broadway, Boulder, Colorado* 80302 (2741425)

PROJECT OBJECTIVE: To develop technology for reliable measurement of physical properties of solar plasmas (temperatures, densities, velocities and magnetic fields), in order to understand and predict the flare phenomenon, the mechanics of the convection zone, and the transport of energy in the overlying atmosphere.

PROJECT APPROACH: Reduction and analysis of NRL/ATM-SKYLAB flare images and numerical modeling of helium resonance lines as a spectroscopic diagnostic for the flare plasma; two-dimensional measurements of steady and oscillatory velocity fields as a function of height in the outer solar atmosphere, using the OSO-8 satellite and the Sacramento peak diode array instrument: numerical modeling of the solar transition region, using observed intensities of EUV resonance lines of metals and helium.

PRIOR YEAR ACCOMPLISHMENTS: Develop iodine absorption cell as a laboratory reference standard for observed Doppler shifts in spectral lines: demonstrated for the first time that motions associated with solar convection do penetrate into the upper chromosphere.

SUPPORTED BY U.S. Dept. of Commerce, National Bureau of Standards

10.0004, ANALYSIS OF INTERSTELLAR AND CIRCUMSTELLAR ABSORPTION LINE PROFILES
T.P. Snow, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Astro Geophysics, *1200 University Ave., Boulder, Colorado* 80302 (NSG 5355)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0005, MECHANISMS OF DEFORMATION AND FAILURE APPROPRIATE TO LUNAR CONDITIONS
H.A. Spetzler, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Geological Sciences, *1200 University Ave., Boulder, Colorado* 80302 (NSG 7584)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0006, PALEOHYDROLOGY OF MARS
D. Nummedal, Louisiana State University, Shreveport Campus, Graduate School, *Shreveport, Louisiana* 71105 (NSG 7542)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0007, X-RAY CLUSTERS OF GALAXIES, GAS DYNAMICS AND RELATIVISTIC PARTICLE PROPAGATION
J.S. Scott, University of Maryland, College Park Campus, School of Engineering, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (NSG 7555)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0008, CREEP AND FRACTURE PROPERTIES OF THE MOON
R.J. OConnell, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Geological Sciences, *Cambridge Station, Cambridge, Massachusetts* 02138 (NSG 7513)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0009, THEORETICAL ASTROPHYSICS
A. Dalgarno, Smithsonian Institution, Astrophysical Observatory, *60 Garden St., Cambridge, Massachusetts* 02138 (3IT-4T50-01)

Computation programs have been developed for constructing models of the basic atomic and molecular processes in the creation, generation, and dissipation of energy. This theoretical research will help establish the parameters for study of terrestrial, stellar and planetary atmospheres, as well as the interstellar and intergalactic mediums.

Detailed calculations were performed of the ultraviolet fluorescent pumping mechanism for populating the rotational levels of molecular hydrogen and used to construct models of interstellar clouds. Quantitative studies of chemical schemes for the formation of interstellar molecules were continued. The efficiency of the main cooling process in diffuse clouds containing molecular hydrogen was calculated.

Theoretical investigations of a wide range of atomic and molecular processes of atmospheric and astrophysical interest were carried out.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0010, GALACTIC DYNAMICS - CELESTIAL MECHANICS - SOLAR SYSTEM DYNAMICS
M. Lecar, Smithsonian Institution, Astrophysical Observatory, *60 Garden St., Cambridge, Massachusetts* 02138 (3IT-4T50-02; 03; 04)

Drs. Lecar and F. Franklin continued their study of the dynamical evolution of the asteroid belt. Orbits between 3.3 and 4.0 AU were found to be stable for thousands of years, but this region is unpopulated in the solar system. They are now studying the very long-term perturbations of Jupiter. W. Wiesel, a doctoral student of Lecar, established that Jupiter's resonant perturbations produced gaps in the asteroid belts at the observed locations, but concluded that an additional mechanism, such as collisions, is required to clean out the gaps.

Lecar studied the tidal circularization of close binary stars. With J.C. Wheeler and C. McKee, they were able to satisfactorily explain the observed low eccentricity of the binary X-ray source Hercules X-1. However, they concluded that the source in Centaurus X-3 is probably spiralling into the primary.

With G. Mybicki and M.M. Schaefer, Lecar completed a study of the rotation curves of spiral galaxies. They concluded that a substantial mass could exist exterior to the measured rotation curves without distorting those curves. This rationalized the 21 cm observations of M. Roberts at NRAO who found that this was the case in the nearby galaxy Andromeda.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0011, MILLIMETER WAVE TELESCOPE

A.E. Lilley, Smithsonian Institution, Astrophysical Observatory, *60 Garden St., Cambridge, Massachusetts* 02138 (31R-4R50-03)

Study program for the construction of a new millimeter wave radiotelescope, establishment of design goals and preliminary contact with designers and builders.

SUPPORTED BY Smithsonian Institution, Astrophysical Observatory

10.0012, GROUPS OF GALAXIES

J.R. Gott, Princeton University, Graduate School, Dept. of Astrophysical Science, *205 Nassau Hall, Princeton, New Jersey* 08540 (AST7624481 A01)

Most galaxies in the universe including our own are members of small groups. A systematic study of groups of galaxies has been started by developing a computer algorithm for identifying small groups as surface density enhancements in the sky (Turner and Gott). In collaboration with S. Aarseth in England, several 1000-body and 4000-body dynamical simulations of galaxy clustering in an expanding universe have been made. The simulations can then be observed and catalogues made of groups of galaxies just as is done for the observations. So far the results have been quite promising. Galaxy pair separations in the simulations are nearly identical to those observed and groups of galaxies in the simulations compare well with observed groups. Computer runs representing both open and closed cosmologies having a variety of initial conditions have been made. By analyzing these simulations, it is hoped to learn more about the masses of galaxies, the formation and properties of groups, and to provide clearer tests of whether the universe is open or closed.

This is a continuation of work done under grant AST 76-24481.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0013, OUTER SOLAR SYSTEM NOMENCLATURE

T.C. Owen, State University of New York, Stony Brook Campus, School of Arts & Sciences, Dept. of Earth & Space Science, *Stony Brook, New York* 11790 (NSG 7553)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0014, SEARCH FOR CORONAL FEATURES OR CIRCUMSTELLAR CLOUDS AROUND SIRIUS

M.P. Savedoff, University of Rochester, School of Arts & Sciences, Dept. of Astronomy, *260 Crittenden Blvd., Rochester, New York* 14627 (NSG 5354)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0015, AN OBSERVATIONAL STUDY OF THE PHYSICAL CONDITIONS IN THE ATMOSPHERES OF RED GIANT STARS

L.W. Ramsey, Pennsylvania State University, University Park Campus, School of Science, Dept. of Astronomy, *211 Whitmore Lab., University Park, Pennsylvania* 16802 (AST7819317)

This proposal will provide support for observational studies of the physical conditions in the atmospheres of red giant stars. The general goal of this study will be assessment of the ability of current theoretical models of the atmospheres of red giant stars to predict the behavior of selected spectral features of these stars. The use of high-dispersion spectroscopy will allow a detailed comparison between observation and theory. Observational programs will be made which will test a number of the physical assumptions used in the theory of the atmospheres of these stars. Studies of these stars are important because they represent a rather late stage in the evolution of the star. Accurate analysis of the abundance of chemical elements in the atmospheres of these stars provide information on the structure of the interior of these stars.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0016, MARS - SIGNIFICANCE OF LARGE OPEN SPACES WITHIN THE NORTH POLAR DUNE FIELDS

R.S. Smith, University of Houston, School of Arts & Sciences, Dept. of Geology, *3801 Cullen Blvd., Houston, Texas* 77004 (NSG 7551)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

GENERAL

11.0001, HISTORY OF ROCKETS AND SPACE FLIGHT

F.C. Durant, Smithsonian Institution, Dept. of Astronautics, *1000 Jefferson Dr. S.W., Washington, District of Columbia* 20560

Refinement of chronological history of rockets and space flight; identification of individuals, inventions and events that influenced technological advances. Major effort includes nineteenth century rocket ordnance, lifesaving and whaling rockets, biographical data, military engagements using rockets, and history of pyrotechnics as related to military rockets. Study of development of literature of spaceflight as related to technology of times. Europe, Eastern Europe, U.S.S.R. and India are foreign areas involved.

SUPPORTED BY Smithsonian Institution, National Air & Space Museum

11.0002, TECHNOLOGY TRANSFER FROM FLIGHT INDUSTRIES TO THE GENERAL ECONOMY

P.A. Hanle, Smithsonian Institution, Science & Technology, *1000 Jefferson Dr. S.W., Washington, District of Columbia* 20560

The goal of this work by three authors is to document in case histories how engineers and their sponsors applied aerospace methods to five complex problems on earth. The cases range from the development of liquified natural gas tankers to the reform of some of California's public services. They include in addition the construction of a 'people mover' in Morgantown, West Virginia; the use of mathematical modeling to simulate the flow of securities; and the use of a technique called 'Delphi' for collecting expert opinions and including a sort of consensus. The focal point of each study lay in analyzing the forces at play in developing a complex system, and all cases are introduced by the editor, as is the volume as a whole. The book is in final draft and is in concluding stages of retyping. It has been submitted for review for possible publication by the SI Press or Cornell Press.

SUPPORTED BY Smithsonian Institution, National Air & Space Museum

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01 AERONAUTICS (GENERAL)

N79-30138*# Rail Co., Baltimore, Md.
MAINTENANCE COST STUDY OF ROTARY WING AIRCRAFT, PHASE 2 Interim Report
Aug. 1979 34 p
(Contract NAS2-9143)
(NASA-CR-152291) Avail: NTIS HC A03/MF A01 CSCL 02A

The Navy's maintenance and materials management data base was used in a study to determine the feasibility of predicting unscheduled maintenance costs for the dynamic systems of military rotary wing aircraft. The major operational and design variables were identified and the direct maintenance man hours per flight hour were obtained by step-wise multiple regression analysis. Five nonmilitary helicopter users were contacted to supply data on which variables were important factors in civil applications. These uses included offshore oil exploration and support, police and fire department rescue and enforcement, logging and heavy equipment movement, and U.S. Army military operations. The equations developed were highly effective in predicting unscheduled direct maintenance man hours per flying hours for military aircraft, but less effective for commercial or public service helicopters, probably because of the longer mission durations and the much higher utilization of civil users. A.R.H.

N79-30139*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
PERFORMANCE EVALUATION METHOD FOR DISSIMILAR AIRCRAFT DESIGNS
Harold J. Walker Sep. 1979 72 p refs
(NASA-RP-1042; H-1064) Avail: NTIS HC A04/MF A01 CSCL 02A

A rationale is presented for using the square of the wingspan rather than the wing reference area as a basis for nondimensional comparisons of the aerodynamic and performance characteristics of aircraft that differ substantially in planform and loading. Working relationships are developed and illustrated through application to several categories of aircraft covering a range of Mach numbers from 0.60 to 2.00. For each application, direct comparisons of drag polars, lift-to-drag ratios, and maneuverability are shown for both nondimensional systems. The inaccuracies that may arise in the determination of aerodynamic efficiency based on reference area are noted. Span loading is introduced independently in comparing the combined effects of loading and aerodynamic efficiency on overall performance. Performance comparisons are made for the NACA research aircraft, lifting bodies, century-series fighter aircraft, F-111A aircraft with conventional and supercritical wings, and a group of supersonic aircraft including the B-58 and XB-70 bomber aircraft. An idealized configuration is included in each category to serve as a standard for comparing overall efficiency. Author

N79-30140# Administrative Sciences Corp., Alexandria, Va.
NAVAL AIRCRAFT OPERATING AND SUPPORT COST-ESTIMATING MODEL, FY 1977 REVISION
Feb. 1979 199 p refs Revised
(Contract N00014-77-C-0180)
(AD-A068175; ASC-R-120; ASC-R-116-Rev) Avail: NTIS HC A09/MF A01 CSCL 05/1

In fiscal year 1974, Administrative Science Corp. developed a parametric cost-estimating model which has been updated and documented several times and used to support numerous Defense Systems Acquisition Review Council (DSARC) reviews as well as other cost reviews. This report provides a detailed documentation of the cost-estimating relationships (CER's) developed from FY-77 data. In addition, the report has been significantly enhanced in order to serve as a handbook and training aid for Op-96D aircraft analysts. For each cost element in the structure, this report provides: (1) a definition; (2) discussion of the definition and other aspects of how, where, and why these costs are incurred, points of contact including organizational codes and telephone numbers, historical data, and sources for planning data; (3) cost-estimating relationship, including all computational procedures, regression statistics for the CER, and the data base; (4) an alternative CER (in many cases) with the same detail as above; and, (5) an example calculation. GRA

N79-30141# Information Spectrum, Inc., Warminster, Pa.
MAINTENANCE IMPROVEMENT: AN ANALYSIS APPROACH INCLUDING INFERENTIAL TECHNICAL DATA Final Report, 27 Dec. 1977 - 15 Mar. 1979
Milton Clyman, Philip S. Grenetz, and Raymond R. Mellott 15 Mar. 1979 322 p
(Contract MDA903-78-C-0176)
(AD-A068382; ISI-W-7958-02C) Avail: NTIS HC A14/MF A01 CSCL 01/3

Tables of input information and output data which were used in assessment of the economic impact (cost and downtime) of potentially avoidable maintenance actions are presented for the F-14A fire control, A-7E and S-3A bombing navigation, and the S-3A landing gear. A.R.H.

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

N79-30142*# Texas A&M Univ., College Station. Aerospace Engineering Dept.
TEST PROBLEMS FOR INVISCID TRANSONIC FLOW
Leland A. Carlson 1 Sep. 1979 57 p refs Presented at the GAMM Workshop on Numerical Methods for the Computation of Inviscid Transonic Flow with Shock Waves, Stockholm, 18-19 Sep. 1979
(Grant NsG-1174)
(NASA-CR-162138; TEES-TAMRF-3224-7804) Avail: NTIS HC A04/MF A01 CSCL 01A

Solving of test problems with the TRANDES program is discussed. This method utilizes the full, inviscid, perturbation potential flow equation in a Cartesian grid system that is stretched to infinity. This equation is represented by a nonconservative system of finite difference equations that includes at supersonic points a rotated difference scheme and is solved by column relaxation. The solution usually starts from a zero perturbation potential on a very coarse grid (typically 13 by 7) followed by several grid halvings until a final solution is obtained on a fine grid (97 by 49). A.W.H.

N79-30143*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

UPPER-SURFACE MODIFICATIONS FOR C SUB l MAX IMPROVEMENT OF SELECTED NASA 6-SERIES AIRFOILS

C. A. Szelazek and Raymond M. Hicks Aug. 1979 79 p refs Prepared in cooperation with Computer Information Systems, Cupertino, Calif.

(NASA-TM-78603; A-7889) Avail: NTIS HC A05/MF A01 CSCL 01A

The thickness of the upper surface of 64 airfoils was increased from the leading edge to the position of maximum thickness. The modifications were generated using a numerical optimization routine coupled with an aerodynamic analysis code. The type of modification presented can be used for aircraft design or for the retrofit of current aircraft to improve the stall characteristics and climb performance. The coordinates of the modified airfoils are presented with plots of the forward 45% of the profiles and pressure distributions for both the modified and unmodified sections at an angle of attack of 14 degrees. K.L.

N79-30144*# Analytical Methods, Inc., Bellevue, Wash.

UNSTEADY FLOW MODEL FOR CIRCULATION-CONTROL AIRFOILS

Balusu M. Rao Jun. 1979 28 p refs

(Contract NAS2-10132)

(NASA-CR-152301) Avail: NTIS HC A03/MF A01 CSCL 01A

An analysis and a numerical lifting surface method are developed for predicting the unsteady airloads on two-dimensional circulation control airfoils in incompressible flow. The analysis and the computer program are validated by correlating the computed unsteady airloads with test data and also with other theoretical solutions. Additionally, a mathematical model for predicting the bending-torsion flutter of a two-dimensional airfoil (a reference section of a wing or rotor blade) and a computer program using an iterative scheme are developed. The flutter program has a provision for using the CC airfoil airloads program or the Theodorsen hard flap solution to compute the unsteady lift and moment used in the flutter equations. The adopted mathematical model and the iterative scheme are used to perform a flutter analysis of a typical CC rotor blade reference section. The program seems to work well within the basic assumption of the incompressible flow. Author

N79-30145*# Bihrle Applied Research, Inc., Jericho, N. Y.

ROTARY BALANCE DATA FOR A TYPICAL SINGLE-ENGINE GENERAL AVIATION DESIGN FOR AN ANGLE-OF-ATTACK RANGE OF 8 DEG TO 90 DEG. 1: HIGH-WING MODEL B

William Bihrle, Jr. and Randy S. Hultberg Sep. 1979 497 p refs

(Contract NAS1-14849)

(NASA-CR-3097) Avail: NTIS HC A21/MF A01 CSCL 01A

Aerodynamic characteristics obtained in a rotational flow environment utilizing a rotary balance located in a spin tunnel are presented in plotted form for a 1/6.5 scale, single engine, high wing, general aviation airplane model. The configurations tested included the basic airplane, various wing leading-edge devices, tail designs, and rudder control settings as well as airplane components. Data are presented without analysis for an angle of attack range of 8 deg to 90 deg and clockwise and counter-clockwise rotations covering an omega b/2V range from 0 to 0.85. Author

N79-30146*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

INVESTIGATION OF THE ASYMMETRIC AERODYNAMIC CHARACTERISTICS OF CYLINDRICAL BODIES OF REVOLUTION WITH VARIATIONS IN NOSE GEOMETRY AND ROTATIONAL ORIENTATION AT ANGLES OF ATTACK TO 58 DEGREES AND MACH NUMBERS TO 2

Robert L. Kruse, Earl R. Keener, Gary T. Chapman, and Gary Claser (ARO, Inc., Moffett Field, Calif.) Sep. 1979 98 p

(NASA-TM-78533; A-7640) Avail: NTIS HC A05/MF A01 CSCL 01A

Wind-tunnel tests were conducted to investigate the side forces and yawing moments that can occur at high angles of attack and zero sideslip for cylindrical bodies of revolution. Two bodies having several tangent ogive forebodies with fineness ratios of 0.5, 1.5, 2.5, and 3.5 were tested. The forebodies with fineness ratios of 2.5 and 3.5 had several bluntnesses. The cylindrical afterbodies had fineness ratios of 7 and 13. The model components - tip, forebody, and afterbody - were tested in various rotational positions about their axes of symmetry. Most of the tests were conducted at a Mach number of 0.25, a Reynolds number of 0.32 x 10 to the 6th power, and with the afterbody that had a fineness ratio of 7 and with selected forebodies. The effect of Mach number was determined with the afterbody that had a fineness ratio of 13 and with selected forebodies at mach numbers from 0.25 to 2 at Reynolds number = 0.32 X 10 to the 6th power. Maximum angle of attack was 58 deg. Author

N79-30147*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

FLOW VISUALIZATION STUDIES OF A GENERAL RESEARCH FIGHTER MODEL EMPLOYING A STRAKE-WING CONCEPT AT SUBSONIC SPEEDS

James M. Luckring Aug. 1979 93 p

(NASA-TM-80057; L-12673) Avail: NTIS HC A05/MF A01 CSCL 01A

A systematic wind tunnel study was conducted in the Langley high-speed 7 by 10 foot tunnel to document, by oil-flow photographs, the surface flow patterns for configurations incorporating strake-wing geometries indicative of current and proposed maneuvering aircraft. The configurations employed combinations of strakes with reflexed planforms having exposed spans of 10 percent, 20 percent, and 30 percent of the reference wing span and wings with trapezoidal planforms having leading-edge sweep angles of approximately 30 deg, 44 deg, and 60 deg. Tests were conducted at Mach numbers of 0.3 and 0.5 and at angles of attack ranging from approximately 5 deg to 30 deg in 5 deg increments at 0 deg sideslip. The configurations incorporating the strake-wing geometries exhibited more organized flow patterns with smaller asymmetries to higher angles of attack than the corresponding configurations incorporating the wing-alone geometries did. Author

N79-30148# Northrop Corp., Hawthorne, Calif. Aircraft Group.

ANALYSIS OF WIND TUNNEL DATA PERTAINING TO HIGH ANGLE OF ATTACK AERODYNAMICS. VOLUME 1: TECHNICAL DISCUSSION AND ANALYSIS OF RESULTS Progress Report, Jun. 1977 - Apr. 1978

Jack W. Headley Jul. 1978 180 p 2 Vol.

(Contract F33615-77-C-3062; AF Proj. 2404)

(AD-A069646; NOR-78-69-Vol-1; AFFDL-TR-78-94-Vol-1) Avail: NTIS HC A09/MF A01 CSCL 20/4

This report provides a technical discussion and analysis of wind tunnel data obtained from tests conducted on a family of Northrop fighter aircraft. These tests were performed mainly in the Northrop Low Speed Wind Tunnel, and cover the time period between 1966 and 1976. This report concentrates on data in the stall post-stall region, and for convenience is provided in two sections. This volume presents the results of the analysis of wind tunnel data which concentrates on the high angle of attack regime, and on three major aircraft components. These components are the nose and forebody, the wing leading edge extension, and the vertical tail. The effects of geometric changes in these components on the aircrafts' high angle of attack aerodynamics are analysed. Wherever possible design guidelines which identify the sensitivity of aerodynamic characteristics to geometric parameter variations are presented. Geometric changes or effects which were configuration dependent are also discussed. The second volume, Volume 2: 'Data base,' contains

summaries of the wind tunnel tests which were selected to provide data for the analysis. GRA

N79-30149# Northrop Corp., Hawthorne, Calif. Aircraft Group.
ANALYSIS OF WIND TUNNEL DATA PERTAINING TO HIGH ANGLE OF ATTACK AERODYNAMICS. VOLUME 2: DATA BASE Progress Report, Jun. 1977 - Apr. 1978
Jack W. Headley Jul. 1978 571 p refs 2 Vol.
(Contract F33615-77-C-3062; AF Proj. 2404)
(AD-A069647; NOR-78-69-Vol-2; AFFDL-TR-78-94-Vol-2) Avail: NTIS HC A24/MF A01 CSCL 20/4

This volume presents, in summary form, the geometric and aerodynamic data used as a basis for the design guidelines presented in Volume 1. The summaries have been divided into eight sections, the first seven being the low speed tests, which include almost all the configuration development studies and most of the high AOA testing. Data summaries for the transonic and supersonic testing form the eighth and last section. Because of the considerable quantity of data available from all the testing (some test reports containing as much as thirteen volumes), it is not practical to include the summaries in all the basic aerodynamic data available. In general, only the main aerodynamic effects are presented or summarized, and for more detailed information on a particular configuration, reference should be made to the actual wind tunnel report. All the data summaries are presented in a similar way, and include the following information: a data sheet including the test report title, a summary of the report, and the test conditions; a general three view of a representative test model configuration; detailed sketches of the pertinent configurations changes; and the relevant aerodynamic data. GRA

N79-30150# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium). Dept. of Aerospace.
HEAT TRANSFER AND PRESSURE MEASUREMENT ON A CONCAVE CONIC MODEL UNDER BOTH STEADY AND UNSTEADY HYPERSONIC FLOW CONDITIONS Interim Report, 1 Dec. 1977 - 30 Nov. 1978
Bryan E. Richards Nov. 1978 48 p refs
(Grant AF-AFOSR-3474-78; AF Proj. 2307)
(AD-A069883; VKI-Internal-Note-61; AFOSR-79-0658TR) Avail: NTIS HC A03/MF A01 CSCL 20/4

Heat transfer and pressure measurements have been measured on a conic configuration with a strongly concave surface and a blunt nose tip in the von Karman Institute Longshot free piston tunnel at M-15 and 20. The test flow parameters achieved closely simulated reentry aerodynamic conditions. Information derived from the measurements and also from high speed cine schlieren sequences enabled information to be derived on the effect of Mach number, Reynolds number, surface roughness and flow incidence on the flow over the model, the heat transfer distribution and stability of the flow. GRA

N79-30151# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.
A FLOW FIELD STUDY FOR TOP MOUNTED INLETS ON FIGHTER AIRCRAFT CONFIGURATIONS Final Report, Oct. 1977 - Sep. 1978
Steven W. Prince Jan. 1979 61 p refs
(F41421000)
(AD-A069732; DTNSRDC/ASED-79/03) Avail: NTIS HC A04/MF A01 CSCL 20/4

A flow visualization study was conducted for top mounted inlets on fighter aircraft. A generic fighter model was tested at low speed in a wind tunnel with a tuft grid mounted on the upper fuselage. Tuft patterns were photographed in four longitudinal positions from 0 to 39 deg angle of attack and from 0 to 30 deg sideslip. Various configurations were tested with a high or low delta wing, two leading edge extensions and two canards. The results indicate that the downwash from leading edge extensions or canards can produce fairly smooth and straight flow to high angles of attack and moderate angles of sideslip for an inlet mounted on the upper fuselage surface. GRA

N79-30152*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AERODYNAMIC RESISTANCE REDUCTION OF ELECTRIC AND HYBRID VEHICLES Progress Report, Sep. 1978
Apr. 1979 85 p refs
(Contracts NAS7-100; EM-78-I-01-4209)
(NASA-CR-162135; HCP/M5030-274) Avail: NTIS HC A05/MF A01 CSCL 01A

The generation of an EHV aerodynamic data base was initiated by conducting full-scale wind tunnel tests on 16 vehicles. Zero-yaw drag coefficients ranged from a high of 0.58 for a boxey delivery van and an open roadster to a low of about 0.34 for a current 4-passenger prototype automobile which was designed with aerodynamics as an integrated parameter. Characteristic effects of aspect ratio or fineness ratio which might appear if electric vehicle shape proportions were to vary significantly from current automobiles were identified. Some preliminary results indicate a 5 to 10% variation in drag over the range of interest. Effective drag coefficient wind-weighting factors over J227a driving cycles in the presence of annual mean wind fields were identified. Such coefficients, when properly weighted, were found to be from 5 to 65% greater than the zero-yaw drag coefficient in the cases presented. A vehicle aerodynamics bibliography of over 160 entries, in six general categories is included. DOE

N79-30153# Virginia Univ., Charlottesville. Dept. of Mechanical and Aerospace Engineering.
MAGNUS EFFECT ON SPINNING BODIES OF REVOLUTION Final Technical Report, 20 Jan. 1976 - 19 Jan. 1979
D. S. Joshi, I. D. Jacobson, J. B. Morton, and P. A. Torpey May 1979 16 p refs
(Grant DAAG29-76-G-0126)
(AD-A069398; UVA/525011/MAE79/103; UVA/525011/MAE79/104; ARO-13408.1-EX) Avail: NTIS HC A02/MF A01 CSCL 20/4

A numerical finite difference method is developed to solve the three dimensional laminar/turbulent boundary layer equations on a spinning body of revolution at an angle of attack in supersonic flow. Influence of asymmetric transition and the presence of mixed boundary layers is considered to predict Magnus forces and moments. Several contributions to the Magnus effects are considered. These include asymmetric boundary layer displacement thickness, centrifugal pressure, and primary and cross flow wall shear stresses. Boundary layer structure defined by asymmetric transition is shown to critically influence the aerodynamic forces and moments on bodies of revolution. Important variables in the flow field are identified by considering variations of spin rate, Mach number, angle of attack and length of the body. Comparisons are made with experimental data and other theoretical analyses. GRA

N79-30154# European Space Agency, Paris (France).
PSEUDO-UNSTEADY METHODS FOR TRANSONIC FLOW CALCULATIONS
Henri Viviand and Jean-Pierre Veuillot Feb. 1979 86 p refs Transl. into ENGLISH of 'Methodes pseudo-instationnaires pour le calcul d'ecoulements transoniques', ONERA, Paris Report ONERA-P-1978-4, 1978
(ESA-TT-549; ONERA-P-1978-4) Avail: NTIS HC A05/MF A01

A synthesis is given the work performed at ONERA on the pseudo-unsteady approach to the numerical calculation of two-dimensional transonic steady flows. Two methods are proposed and discussed: the first one, based on the assumption of a uniform total enthalpy, permits the calculation of non-isentropic rotational flows, even with strong shocks; the second one, which furthermore assumes a uniform entropy, can only be applied to potential flows but permits, within this approximation, the treatment or weak shocks. The mathematical properties of the system of unsteady equations used were studied for each of these methods and the determination of the characteristic cone led to the establishment of a stability criterion for explicit numerical schemes. In particular, an artificial unsteady term was introduced into the continuity equation in the second method to improve the stability properties. Starting from the MacCormack predictor-corrector scheme, various discretization techniques of the equations in arbitrary curvilinear meshes are discussed. A new technique of direct discretization in the physical plane, with arbitrary meshes, is proposed which makes it possible to avoid the use of a coordinate transformation. Various methods for dealing with the slip condition at wall are presented. A general method for treating the boundary conditions, based on the use of

compatibility relations, is proposed. The implementation of these two methods is illustrated by various numerical applications.
Author (ESA)

N79-30155# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Angewandte Gasdynamik.
ANALYSIS OF CALCULATED THREE-DIMENSIONAL INVISCID FLOW FIELDS WITH EMBEDDED SHOCK WAVES: PRESENTATION OF A FIELD SOLUTION, PART 1
Claus Weiland and Hans-Juergen Thies (Tech. Univ., Berlin) Apr. 1978 72 p refs In GERMAN; ENGLISH summary Report will be also announced as translation (ESA-TT-558)
(DLR-FB-78-09) Avail: NTIS HC A04/MF A01; DFVLR, Cologne DM 27,90

Flow fields around a number of different body contours, which have been calculated by means of a finite-difference procedure, are analyzed. The investigated fields are three-dimensional in general. The analysis is carried out with the aid of characteristics, streamlines, lines of constant static pressure and static density, and with the velocity vectors at the gridpoints in planes phi = const. Planes z = const. lines of constant crossflow Mach number and the velocity vectors of the crossflow at the gridpoints are presented. The interval of freestream Mach number considered is 1.4 less than or equal to M sub infinity less than or equal to 3, and the range of angle of attack alpha is up to 20 deg. The quality of the finite-difference solution used is demonstrated by comparison with experimental data. The accuracy attained especially for the detection of the position and the contour of embedded shocks is very good. Author (ESA)

N79-30156# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Theoretische Stroemungsmechanik.
PRESSURE DISTRIBUTION MEASUREMENTS ON WEDGES AT SUBSONIC AND TRANSONIC VELOCITIES
Mauri Tanner Oct. 1978 60 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-554)
(DLR-FB-78-22) Avail: NTIS HC A04/MF A01; DFVLR, Munich DM 19,70

Measurements were performed in a wind tunnel on three wedges (apex angles of 8, 15, and 30 deg). Formulas are given for calculating pressure distribution and other characteristics associated with the wedge. A series of curves is presented. Some comparisons are made with theoretically expected results. It is observed that the pressure distribution on the wedge flank, the base pressure and the pressure drag vary considerably with Mach number and wedge angle. Author (ESA)

N79-30157# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Stroemungsmechanick.
AFTERBODY DRAG AND BASE PRESSURE MEASUREMENTS ON A BODY OF REVOLUTION AT ANGLES OF INCIDENCE UP TO ALPHA EQUALS 25 DEG AT SUBSONIC AND TRANSONIC MACH NUMBERS
Mauri Tanner Jun. 1978 77 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-569)
(DLR-FB-78-14) Avail: NTIS HC A05/MF A01; DFVLR, Cologne DM 26,90

Base pressure and afterbody drag measurements were performed in a wind tunnel. The Mach number had values from 0.5 to 1.0. The Reynolds number based on the model diameter was 340,000. Results show the influence of the boat-tail angle, the boat-tail length, and the relative base diameter on the base pressure and the afterbody drag at various angles of incidence.
Author (ESA)

N79-30158# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Aerodynamik.
ON DISTURBANCE FIELDS OF MOVING SINGULARITIES IN AERODYNAMICS AND AEROACOUSTICS
Arabindo Das May 1978 95 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-570)
(DLR-FB-78-16) Avail: NTIS HC A05/MF A01; DFVLR, Cologne DM 38,10

A unified method of treatment is presented in which arbitrary translatory motions of the disturbance sources, of the medium, and of the field point are admired. The influence factors which arise from the kinematics of the disturbance field are derived in detail and the physical processes involved are elucidated. For linearized theory it follows that the Mach number influence due to the motion of singularities is solely a kinematic effect and not a compressibility effect. Furthermore, the significance of the Lorentz Transformation in problems of disturbance propagation from moving singularities is pointed out. It provides the basis for presenting source solutions in a space-time continum. Also, the treatment includes an evaluation of energy density and energy flux. Author (ESA)

N79-30159# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Angewandte Gasdynamik.
DEVELOPMENT OF THE FLOW FIELD IN STREAMWISE CORNERS AT HYPERSONIC SPEEDS AND EFFECTS OF THE CORNER FLOW ON DOWNSTREAM FITTED FLAPS
Hermann Josef Schepers Aug. 1978 146 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-583)
(DLR-FB-78-23) Avail: NTIS HC A07/MF A01; DFVLR, Cologne DM 49,80

Results obtained from investigations carried out on three different configurations of streamwise cornered are described. The experiments were conducted at a free stream Mach number of M equals 8.8 and a Reynolds number of Re/m equals 4,566,000 in the hypersonic wind tunnel of the DFVLR institute for Applied Gas Dynamics. The pilot pressure, static pressure, and total temperature in the flow field were measured to determine the essential flow quantities. A semi-empirical analysis drawn up on the basis of known shock relations revealed that the state variables behind curves secondary shocks coincide well with the experimental results. The major characteristics of the near-to-wall flow were both pointed out and explained in the corner by making the wall stream lines visible and by measuring the heat transfer and static pressure at the wall. An approximates correlation was achieved between the calculation and the experiment in the estimation of the influence on the rudder efficiency produced by the corner flows. Author (ESA)

N79-30160# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Aeroelastik.
THE HARMONICALLY OSCILLATING BODY IN SUBSONIC FLOW: EFFECT OF COMPRESSIBILITY
Wolfgang Geissler Nov. 1978 47 p refs In GERMAN; ENGLISH summary Report will be also announced as translation (ESA-TT-584)
(DLR-FB-78-24) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 20,20

The calculation of steady and unsteady airloads on harmonically oscillating bodies can be done by means of source- and sink-distributions on the real body surface. It is useful to do the calculation in a body fixed frame of reference. Pressures and forces on oscillating bodies have already been obtained for incompressible flow. The extension of this method to compressible subsonic flow is discussed. Numerical results are compared with other available methods for steady and unsteady flow about bodies. Author (ESA)

N79-30161# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Aerodynamik.
THEORETICAL ESTIMATION OF NONLINEAR LONGITUDINAL CHARACTERISTICS OF WINGS WITH SMALL AND MODERATE ASPECT RATIO BY THE VORTEX-LATTICE METHOD IN INCOMPRESSIBLE FLOW
Wolfgang Schroeder Sep. 1978 82 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-585)
(DLR-FB-78-26) Avail: NTIS HC A05/MF A01; DFVLR, Cologne DM 31,80

A nonlinear vortex-lattice method is described applying a force-free condition to the vortex sheet giving the trailing, side- and leading edges, respectively. In extensive test runs various influences on the numerical stability of the iterative rolling-up process were studied such as the force-free condition of the wake, the number of horseshoe vortices, the panel distribution along span and chord, the representation of the wakes by chains of straight vortex elements of different length and number, and the introduction of an artificial friction parameter. Because of numerical difficulties the slender delta wing itself could not be treated completely. These numerical difficulties resulting from the singular behavior of line vortices are described and ways of overcoming them are suggested. Author (ESA)

N79-30162# National Technical Information Service, Springfield, Va.
LIGHTER THAN AIR VEHICLES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Mar. 1979
Guy E. Habercom, Jr. May 1979 256 p Supersedes NTIS/PS-78/0409; NTIS/PS-77/0374
(NTIS/PS-79/0471/7; NTIS/PS-78/0409; NTIS/PS-77/0374) Avail: NTIS HC $28.00/MF $28.00 CSCL 01C

Designs and applications of balloons, dirigibles, and airships are investigated in this Government sponsored research. Passenger or cargo transport, timbering, tethering, and fabric selection are discussed. Meteorological balloons are excluded. This updated bibliography contains 250 abstracts, 16 of which are new entries to the previous edition. GRA

N79-30163# National Technical Information Service, Springfield, Va.
LIGHTER THAN AIR VEHICLES. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Apr. 1979
Guy E. Habercom, Jr. May 1979 88 p Supersedes NTIS/PS-78/0410; NTIS/PS-77/0375
(NTIS/PS-79/0472/5; NTIS/PS-78/0410; NTIS/PS-77/0375) Avail: NTIS HC $28.00/MF $28.00 CSCL 01C

Design and applications of balloons, dirigibles, and airships are investigated. Passenger or cargo transport, timbering, tethering, and fabric selection are discussed. Meteorological balloons are excluded. This updated bibliography contains 82 abstracts, 8 of which are new entries to the previous edition. GRA

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N79-30164 Fordham Univ., New York, N. Y.
FINANCING THE CAPITAL REQUIREMENTS OF THE US AIRLINE INDUSTRY IN THE 1980'S Ph.D. Thesis
Robert William Mandell 1979 245 p
Avail: Univ. Microfilms Order No. 7918290

The study presented estimated capital requirements from the close of this decade to the close of the maximum fleet replacement cycle in 1994, under alternative assumptions. It also forecasted internally generated funds and reasonable amounts of additional debt which can be summoned to meet those needs. It was concluded that in order for the industry to approach meeting the projected levels of demand for air travel, the following measures are imminently required: (1) liberalization of the investment tax credit with respect to the purchase of new aircraft; (2) swift deregulation of the industry; and (3) permit mergers between airlines with complementary route structures. Dissert. Abstr.

N79-30165*# Lightning Technologies, Inc., Pittsfield, Mass.
THE FEASIBILITY OF INFLIGHT MEASUREMENT OF LIGHTNING STRIKE PARAMETERS
K. E. Crouch and J. A. Plumer Oct. 1978 91 p refs
(Contract NAS1-15216)
(NASA-CR-158981) Avail: NTIS HC A05/MF A01 CSCL 01C

The appearance of nonmetallic structural materials and microelectronics in aircraft design has resulted in a need for better knowledge of hazardous environments such as lightning and the effects these environments have on the aircraft. This feasibility study was performed to determine the lightning parameters in the greatest need of clarification and the performance requirements of equipment necessary to sense and record these parameters on an instrumented flight research aircraft. It was found that electric field rate of change, lightning currents, and induced voltages in aircraft wiring are the parameters of greatest importance. Flat-plate electric field sensors and resistive current shunts are proposed for electric field and current sensors, to provide direct measurements of these parameters. Six bit analog-to-digital signal conversion at a 5 nanosecond sampling rate, short-term storage of 85000 bits and long term storage of 5 x 10 to the 7th power bits of electric field, current and induced voltage data on the airplane are proposed, with readout and further analysis to be accomplished on the ground. A NASA F-106B was found to be suitable for use as the research aircraft because it has a minimum number of possible lightning attachment points, space for the necessary instrumentation, and appears to meet operational requirements. Safety considerations are also presented. F.O.S.

N79-30166# Federal Aviation Administration, Washington, D. C. Office of Aviation Policy.
TERMINAL AREA FORECASTS, FISCAL YEARS 1979-1990
Pamela G. Kruzic, Thomas F. Henry, and Carlton R. Wine Jun. 1978 455 p
(FAA-AVP-78-6) Avail: NTIS HC A20/MF A01

Forecasts are presented of key aviation activity measures for 905 airports and radar approach control facilities through the year 1990. These forecasts are prepared to meet the planning needs of the Federal Aviation Administration (FAA) offices and services concerned with future traffic levels at these facilities. A general summary is presented which includes summary highlights, the introduction, a brief overview of the forecast methodology, and an extensive series of summary tables and charts. This summary provides a useful national overview as well as a comparison among regions. The forecasts for each airport are included. The airports in each state are listed alphabetically by community and include summary information for the facility followed by annual projections for FY-1979 through 1990. The summary indicates the airport's tower/nontower status, daily hours of tower operations, presence of scheduled commuter passenger service, the number of aircraft based at the airport and the 1977 military operations. F.O.S.

N79-30167# National Transportation Safety Board, Washington, D. C. Bureau of Technology.
SPECIAL INVESTIGATION REPORT: WING FAILURE OF BOEING 747-131 NEAR MADRID, SPAIN, 9 MAY 1976
6 Oct. 1978 41 p refs
(NTSB-AAR-78-12) Avail: NTIS HC A03/MF A01

On May 9, 1976, an Imperial Iranian Air Force Boeing 747-131 crashed as it approached Madrid, Spain. Witnesses observed lightning strike the aircraft followed by fire, explosion, and separation of the left wing. The report includes fire pattern studies, structural failure descriptions, trajectory analysis, fuel flammability calculations, gust loading analysis, and an analytical treatment of several hypotheses. G.Y.

N79-30168 Committee on Commerce, Science, and Transportation (U. S. Senate).
INTERNATIONAL AIR TRANSPORTATION COMPETITION ACT OF 1978
Washington GPO 1978 285 p refs Hearings on S. 3363 before the Subcomm. on Aviation of the Comm. on Commerce, Sci., and Transportation, 95th Congr., 2d Sess., 22-24 Aug. 1978
(GPO-34-912) Avail: Subcomm. on Aviation.

Testimony was given and arguments were heard to amend the Federal Aviation Act of 1958 in order to promote competition in International Air Transportation, provide greater opportunities for United States air carriers, create a structure and establish

goals for developing United States International Aviation negotiating policy, and for other purposes. M.M.M.

N79-30169# Technology/Scientific Services, Inc., Dayton, Ohio.
ATMOSPHERIC ELECTRICITY HAZARD (AEH) Final Report, 11 Jul. - 30 Sep. 1978
Arturo V. Serrano Dec. 1978 168 p refs
(Contract F33601-78-D-0042; AF Proj. 2202)
(AD-A069338; T/SSI-0140-01; AFFDL-TR-78-164) Avail: NTIS HC A08/MF A01 CSCL 01/3

A literature survey relating to the survivability of aircraft transparencies and electrical circuits embedded within them was performed. The types of materials used in transparencies and their edge construction were identified, the electrical properties of interest were defined along with test methods in use or available, the availability of electrical properties for the materials of interest was determined, the physiological hazards were documented, and analytical methods for evaluation of transparency systems were identified. As a result of this study it was concluded that the electrical parameters of interest are affected by temperature, frequency and exposure and that data for the materials of interest are not generally available over the ranges of interest for these parameters. It was also concluded that insufficient information is currently available for evaluation of the physiological hazards. Finally, analytical models for evaluation of transparency systems in an electromagnetic environment were found available that could be used to analyze transparency designs. However, these methods need to be computerized and validated. Recommendations are made to eliminate existing data gaps by tests and analyses. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N79-30170# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.
ON THE ACCURACY IMPROVEMENT OF INCREMENTAL READOUT TECHNIQUES FOR INERTIAL SENSORS Ph.D. Thesis - Tech. Univ., Brunswick
Dietrich Rahlfs Apr. 1978 118 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-573)
(DLR-FB-77-70) Avail: NTIS HC A06/MF A01; DFVLR, Cologne DM 60,80

Incremental feedback techniques offer digital readout for inertial sensors with high resolution. A binary pulse width modulated quantizer is analyzed and an incremental feedback loop is synthesized. The accuracy of the readout depends on the time stability of the feedback time-current pulses. Generation of high precision time-current pulses is investigated and the readout technique is applied to three types of pendulous accelerometers. Relative stability of better than 1/1,000,000 per day was obtained. Suggestions for further improvment of readout techniques for inertial sensors are given. This technique can be applied in general to any current sensor with integrating behavior. Author (ESA)

N79-30171# National Technical Information Service, Springfield, Va.
OMEGA NAVIGATION SYSTEM. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - May 1979
William E. Reed Jun. 1979 313 p
(NTIS/PS-79/0615) Avail: NTIS HC $28.00/MF $28.00 CSCL 17G

The development and utilization of the Omega navigation system are treated in these federally sponsored research reports. Topics covered include signal propagation, equipment and operational evaluation. Differential Omega is also discussed. This updated bibliography contains 298 abstracts, of which 22 are new to the previous edition. GRA

N79-30172# National Technical Information Service, Springfield, Va.
OMEGA NAVIGATION SYSTEM. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - May 1979
William E. Reed Jun. 1979 196 p
(NTIS/PS-79/0616) Avail: NTIS HC $28.00/MF $28.00 CSCL 17G

Research reports on the development and utilization of the Omega navigation system are cited from worldwide research. Aspects covered include signal propagation, equipment, and operational evaluation. Studies on differential Omega are included. This updated bibliography contains 188 abstracts of which 10 are new to the previous edition. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N79-30173*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
RADIO-CONTROLLED MODEL DESIGN AND TESTING TECHNIQUES FOR STALL/SPIN EVALUATION OF GENERAL-AVIATION AIRCRAFT
Sanger M. Burk, Jr. and Calvin F. Wilson, Jr. (Piper Aircraft Corp., Lock Haven, Penn.) 1975 63 p refs Presented at the 1975 SAE Natl. Business Aircraft Meeting, Wichita, Kansas, 8-11 Apr. 1975
(NASA-TM-80510) Avail: NTIS HC A04/MF A01 CSCL 01C

A relatively inexpensive radio-controlled model stall/spin test technique was developed. Operational experiences using the technique are presented. A discussion of model construction techniques, spin-recovery parachute system, data recording system, and movie camera tracking system is included. Also discussed are a method of measuring moments of inertia, scaling of engine thrust, cost and time required to conduct a program, and examples of the results obtained from the flight tests. K.L.

N79-30174 Committee on Armed Services (U. S. House).
ENFORCER AIRCRAFT
Washington GPO 1978 154 p refs Hearing before the Research and Development Subcomm. of the Comm. on Armed Services, 95th Congr., 2d Sess., 22 Jun. 1978
(GPO-32-569; HASC-95-86) Avail: Research and Development Subcomm.

The utility of a privately developed Enforcer-type aircraft as a tank killer in either the battlefield interdiction or close air support is assessed with emphasis on lethality and vulnerability. Characteristics are compared to those of the A-10 aircraft. A.R.H.

N79-30175*# Foster-Miller Associates, Inc., Waltham, Mass.
HEAVE-PITCH-ROLL ANALYSIS AND TESTING OF AIR CUSHION LANDING SYSTEMS Final Report
A. B. Boghani, K. M. Captain, and D. N. Wormley Feb. 1978 205 p refs
(Contract NAS1-12403)
(NASA-CR-2917) Avail: NTIS HC A10/MF A01 CSCL 01C

The analyical tools (analysis and computer simulation) needed to explain and predict the dynamic operation of air cushion landing systems (ACLS) is described. The following tasks were performed: the development of improved analytical models for the fan and the trunk; formulation of a heave pitch roll analysis for the complete ACLS; development of a general purpose computer simulation to evaluate landing and taxi performance of an ACLS equipped aircraft; and the verification and refinement of the

analysis by comparison with test data obtained through lab testing of a prototype cushion. Demonstration of simulation capabilities through typical landing and taxi simulation of an ACLS aircraft are given. Initial results show that fan dynamics have a major effect on system performance. Comparison with lab test data (zero forward speed) indicates that the analysis can predict most of the key static and dynamic parameters (pressure, deflection, acceleration, etc.) within a margin of a 10 to 25 percent.
A.W.H.

N79-30176*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
SIMILITUDE REQUIREMENTS AND SCALING RELATIONSHIPS AS APPLIED TO MODEL TESTING
Chester H. Wolowicz, James S. Brown, Jr., and William P. Gilbert Aug. 1979 64 p refs Prepared jointly with NASA. Langley Res. Center
(NASA-TP-1435; H-1022) Avail: NTIS HC A04/MF A01 CSCL 01C

The similitude requirements for the most general test conditions are presented. These similitude requirements are considered in relation to the scaling relationships, test technique, test conditions (including supersonic flow), and test objectives. Particular emphasis is placed on satisfying the various similitude requirements for incompressible and compressible flow conditions. For free flying models tests, the test velocities for incompressible flow are scaled from Froude number similitude requirements and those for compressible flow are scaled from Mach number similitude requirements. The limitations of various test techniques are indicated, with emphasis on the free flying model. A.W.H.

N79-30177# Army Aviation Engineering Flight Activity, Edwards AFB, Calif.
AH-1G HELICOPTER, 19-ROUND LIGHTWEIGHT AIRBORNE LAUNCHER JETTISON ENVELOPE DETERMINATION Final Report
Gary L. Skinner and Frederick S. Doten Mar. 1979 30 p refs
(AD-A069828; USAAEFA-78-10) Avail: NTIS HC A03/MF A01 CSCL 19/7

The United States Army Aviation Engineering Flight Activity conducted a limited evaluation of a 19-round prototype launcher to determine a safe jettison envelope for the 19-round lightweight airborne rocket launcher. The evaluation was conducted from 25 May 1978 to 6 June 1978 at Edwards Air Force Base, California. Ten flights using an AH-1G helicopter were conducted totaling 3.5 flight hours. This evaluation defined a safe jettison envelope in coordinated (ball-centered) level flight to 120 knots calibrated airspeed (KCAS) and in autorotation at 70 KCAS. Establishment of a jettison envelope equivalent to that of the M159 and M200 launcher will require 75 7-round and 75 19-round lightweight airborne rocket launchers and 744 2.75-inch Model M229 rockets. Five reliability and maintainability launcher shortcomings were identified during the evaluation of the prototype launcher. GRA

N79-30178# Army Aviation Engineering Flight Activity, Edwards AFB, Calif.
AIRWORTHINESS AND FLIGHT CHARACTERISTICS TEST, OV-1C TAKEOFF PERFORMANCE Final Report, 11 Apr. - 19 Jul. 1978
Raymond B. Smith, George M. Yamakawa, John R. Niemann, Joseph C. Watts, and Jerry R. Guin May 1979 33 p
(AD-A069827; USAAEFA-78-07) Avail: NTIS HC A03/MF A01 CSCL 01/2

The United States Army Aviation Engineering Flight Activity conducted takeoff performance tests on an OV-1C aircraft, serial number 67-18918, from 11 April through 19 July 1978. The aircraft was tested at Edwards Air Force Base (field elevation 2273 feet) and South Lake Tahoe, California (field elevation 6262 feet). Twelve flights totaling 6.9 productive flight hours were conducted. Takeoff performance tests were conducted on the OV-1C to substantiate the performance data currently incorporated in the operator's manual. Tests were conducted using two normal takeoff techniques and a minimum run takeoff technique at each of three gross weights. All takeoffs were made from hard, dry, paved level runways. Test results show that the estimated data for normal takeoff is satisfactory but the data for the minimum run technique in the operator's manual is optimistic. GRA

N79-30179# Textron Bell Helicopter, Fort Worth, Tex.
HELICOPTER OBSTACLE STRIKE TOLERANCE CONCEPTS ANALYSIS Final Report, Sep. 1977 - Jun. 1978
Bharat P. Gupta Apr. 1979 183 p refs
(Contract DAAJ02-77-C-0049; DA Proj. 1L2-62209-AH-76)
(AD-A069877; BHT-699-099-096; USARTL-TR-78-46) Avail: NTIS HC A09/MF A01 CSCL 01/3

A large number of obstacle strikes have occurred during Army helicopter combat missions and nap-of-the-earth (NOE) training missions. Obstacle strike tolerance becomes particularly important for NOE flights in areas containing many obstacles, such as western Europe. This report defines the obstacle strike problem, particularly for tree and wire strikes. Only a small percentage of obstacle strikes produce accidents, but these accidents account for a high proportion of helicopter damage costs. Tree strikes are more common than wire strikes, but the wire strikes are more likely to cause accidents. Generally, the main and tail rotors are most commonly struck, but a high proportion of wire strikes also occur on the fuselage. Helicopter obstacle strike tolerance designs for rotors, fuselage, and controls are analyzed and the most promising concepts are selected for both existing and future helicopter systems. In addition, obstacle strike tolerance design criteria are defined. GRA

N79-30180# Sikorsky Aircraft, Stratford, Conn.
HELICOPTER DRIVE SYSTEM R AND M DESIGN GUIDE Final Report
K. R. Cormier Apr. 1979 91 p ref
(Contract DAAJ02-76-C-0047; DA Proj. 1L2-62209-AH-76)
(AD-A069835; SER-50997; USARTL-TR-78-50) Avail: NTIS HC A05/MF A01 CSCL 01/3

This report is a reliability and maintainability design guide for helicopter drive systems. While not containing 'how to' design information, the guide points out those areas of design which can be troublesome in the reliability and maintainability of helicopter drive systems. Besides containing information on the various drive system components, a management section is included that outlines some practices which design managers may employ to insure that reliability and maintainability are given proper emphasis during a design program. The final section is devoted to a step-by-step procedure for hazard function analysis, which may be used to predict the reliability of a gearbox during the design stage. GRA

N79-30181# United Technologies Corp., Stratford, Conn.
HELICOPTER DRIVE SYSTEM R AND M DESIGN GUIDE Final Report
K. R. Cormier and B. Trustee Apr. 1979 138 p refs
(Contract DAAJ02-76-C-0047; DA Proj. 1L2-62209-AH-76)
(AD-A069691; SER-510012; USARTL-TR-78-51) Avail: NTIS HC A07/MF A01 CSCL 01/3

This report covers the investigations conducted during the Helicopter Drive System R and M Design Guide program. The report discusses the present state of transmission reliability and how reliability and maintainability are dealt with during the design and development of a helicopter drive system. Other topics discussed include the effect of quality control on drive system reliability, drive system maintainability problems, diagnostics, and the likely effect of advanced design concepts on the reliability and maintainability of future drive systems. Two different types of reliability prediction techniques, hazard function analysis and probabilistic design, are discussed, and the strengths and weaknesses of each are outlined. Test planning and maintainability analysis are included as separate appendices. GRA

N79-30182# Sandia Labs., Albuquerque, N. Mex.
DRIFTDOWN CALCULATIONS FOR THE FH/227D AIRCRAFT
L. A. Bertram Feb. 1979 79 p refs
(Contract EY-76-C-04-0789)
(SAND-78-1807) Avail: NTIS HC A05/MF A01

Two codes are described: USIM, which simulates FH-227D flights with an enroute engine loss, and UNDRIFT, which locates the maximum takeoff weights satisfying driftdown terrain clearance and landing weight limits as well as falling within the climb

capability of the aircraft. These codes are presented in a form suitable for use at a remote terminal using the NOS timesharing system for the Sandia CDC 6600 computer and user instructions and examples are given. Some weaknesses in the FAA-approved driftdown analysis procedure are noted and discussed, but it is the approved procedure which is implemented in the codes. DOE

N79-30183# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.

INVESTIGATIONS ON THE DESIGN OF ACTIVE VIBRATION ISOLATION SYSTEMS FOR HELICOPTERS WITH RIGID AND ELASTIC MODELING OF THE FUSELAGE

Gerd Schulz Mar. 1978 72 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-556)

(DLR-FB-78-04) Avail: NTIS HC A04/MF A01; DFVLR, Cologne DM 25,70

Different methods for the design of controllers for active vibration isolation on helicopters are investigated. Based on the special structure of the controller, compensation for the rotor blade harmonic disturbance vibrations is achieved, guaranteeing good trim behavior during maneuvers. For the first controller design, done for a rigid helicopter fuselage with a modified Riccati design, different sensor configurations are investigated. A possibility for sensitivity reduction for rotor speed variations is shown. For the second controller design for an elastic helicopter fuselage the modified Riccati design, the design by means of Nyquist plots and pole assignment are investigated, especially with respect to the applicability for higher order systems. Author (ESA)

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N79-30184# McDonnell Aircraft Co., St. Louis, Mo.

RESEARCH ON VISUAL DISPLAY INTEGRATION FOR ADVANCED FIGHTER AIRCRAFT Final Technical Report, 13 Jul. 1977 - 13 Aug. 1978

George S. Mills, Marshall A. Grayson, Susan L. Loy, and Richard A. Jauer, Jr. Wright-Patterson AFB, Ohio AMRL Nov. 1978 162 p refs

(Contract F33615-77-C-0536; AF Proj. 7184)

(AD-A069605; MDC-A5425; AMRL-TR-78-97) Avail: NTIS HC A08/MF A01 CSCL 01/3

This 'Visual Display Integration' study was conducted to determine the display integration options projected available for inclusion in an attack/fighter aircraft crew station design in the 1985-1990 time. A second objective was the definition of an evaluation framework that would permit evaluation of the selected display options during future related studies. Summarizing the results, it is clearly evident that the CRT, as Option 1, will retain its preeminence as the multifunction display unit for 1985-1990. Option 2 is the flat-panel plasma display, Option 3 is the flat-panel liquid crystal display, and Option 4 is the electroluminescent thin-film-transistor display. It was concluded that man-in-the loop simulations provide the best opportunity for evaluating these display options in future related work. GRA

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N79-30185*# Pratt and Whitney Aircraft Group, East Hartford, Conn.

AERODYNAMIC AND ACOUSTIC INVESTIGATION OF INVERTED VELOCITY PROFILE COANNULAR EXHAUST NOZZLE MODELS AND DEVELOPMENT OF AERODYNAMIC AND ACOUSTIC PREDICTION PROCEDURES, COMPREHENSIVE DATA REPORT, VOLUME 1

Richard S. Larson, Douglas P. Nelson, and Bradley S. Stevens Jun. 1979 312 p 2 Vol.

(Contract NAS3-20061)

(NASA-CR-159515; PWA-5550-16-Vol-1) Avail: NTIS HC A14/MF A01 CSCL 21E

The experimental data necessary to establish aerodynamic and acoustic prediction systems for coannular exhaust nozzles with inverted velocity profiles are presented in graphical form. R.E.S.

N79-30186*# Pratt and Whitney Aircraft Group, East Hartford, Conn.

AERODYNAMIC AND ACOUSTIC INVESTIGATION OF INVERTED VELOCITY PROFILE COANNULAR EXHAUST NOZZLE MODELS AND DEVELOPMENT OF AERODYNAMIC AND ACOUSTIC PREDICTION PROCEDURES, COMPREHENSIVE DATA REPORT, VOLUME 2

Richard S. Larson, Douglas P. Nelson, and Bradley S. Stevens Jun. 1979 225 p refs

(Contract NAS3-20061)

(NASA-CR-159516; PWA-5550-17-Vol-2) Avail: NTIS HC A10/MF A01 CSCL 21E

The experimental data necessary to establish aerodynamic and acoustic prediction systems for coannular exhaust nozzles with inverted velocity profiles are presented in tabular form. The acoustic data are corrected to a 'theoretical day' and scaled to full engine size. R.E.S.

N79-30187*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECT OF STEADY-STATE TEMPERATURE DISTORTION AND COMBINED DISTORTION ON INLET FLOW TO A TURBOFAN ENGINE

Ronald H. Soeder and George A. Bobula Aug. 1979 43 p refs

(NASA-TM-79237; E-143) Avail: NTIS HC A03/MF A01 CSCL 21E

Flow angle, static pressure, total temperature and total pressure were measured in the inlet duct upstream of a turbofan engine operating with temperature distortion or combined pressure-temperature distortion. Such measurements are useful in the evaluation of analytical models of inlet distortion. A rotating gaseous-hydrogen burner and a circumferential 180 degrees-extent screen configuration mounted on a rotatable assembly generated the distortions. Reynolds number index was maintained at 0.5 and engine corrected low-rotor speeds were held at 6000 and 8600 rpm. The measurements showed that at the entrance to the engine, flow angle was largest in the hub region. As flow approached the engine, yaw angle (circumferential variation) increased and pitch angle (radial variation) decreased. The magnitude of static-pressure distortion measured along the inlet-duct and extended bullet nose walls increased exponentially as flow approached the engine. Author

N79-30188*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

A SUMMARY OF NASA/AIR FORCE FULL SCALE ENGINE RESEARCH PROGRAMS USING THE F100 ENGINE

W. J. Deskin (Pratt and Whitney Aircraft Group, West Palm Beach, Fla.) and H. G. Hurrell 1979 24 p refs Presented at 15th Joint Propulsion Conf., Las Vegas, Nev., 18-20 Jun. 1979; Sponsored by AIAA, Am. Soc. of Mech. Engr.

(NASA-TM-79267; E-183) Avail: NTIS HC A02/MF A01 CSCL 21E

A full scale engine research (FSER) program conducted with the F100 engine is presented. The program mechanism is described and the F100 test vehicles utilized are illustrated. Technology items were addressed in the areas of swirl augmentation, flutter phenomenon, advanced electronic control logic theory, strain gage technology and distortion sensitivity. The associated test programs are described. The FSER approach utilizes

existing state of the art engine hardware to evaluate advanced technology concepts and problem areas. Aerodynamic phenomenon previously not considered by design systems were identified and incorporated into industry design tools. A.W.H.

N79-30189*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.
ENERGY EFFICIENT ENGINE FLIGHT PROPULSION SYSTEM PRELIMINARY ANALYSIS AND DESIGN REPORT Progress Report, Mar. 1978 - Feb. 1979
W. B. Gardner Apr. 1979 480 p refs
(Contract NAS3-20646)
(NASA-CR-159487; PWA-5594-49) Avail: NTIS HC A21/MF A01 CSCL 21E

A flight propulsion system preliminary design was established that meets the program goals of at least a 12 percent reduction in thrust specific fuel consumption, at least a five percent reduction in direct operating cost, and one-half the performance deterioration rate of the most efficient current commercial engines. The engine provides a high probability of meeting the 1978 noise rule goal. Smoke and gaseous emissions defined by the EPA proposed standards for engines newly certified after 1 January 1981 are met with the exception of NOx, despite incorporation of all known NOx reduction technology. F.O.S.

N79-30190# Michigan Univ., Ann Arbor. Dept. of Aerospace Engineering.
CRITICAL ASSESSMENT OF EMISSIONS FROM AIRCRAFT PISTON ENGINES Final Report, Jun. 1974 - May 1978
W. Mirsky, J. A. Nicholls, R. Pace, R. Ponsonby, and D. E. Geister Jun. 1979 163 p refs
(Contract DOT-FA74NA-1102)
(AD-A071002; FAA-RD-78-82; FAA-NA-78-166) Avail: NTIS HC A08/MF A01 CSCL 21/7

A comprehensive mathematical analysis for evaluating the measured emissions from piston type general aviation aircraft engines is presented and discussed. The analysis is used to calculate the fuel-air ratio, molecular weight of the exhaust products, and water correction factor. A sensitivity analysis is presented which shows the effects of emission measurement errors on calculated fuel-air ratio. The test facility is briefly described and the associated emissions instrumentation is discussed in detail. The experimental results obtained in this facility on the AVCO-Lycoming LIO-320 engine are presented. This includes baseline and lean-out emissions data and the influence of sampling probe location in the exhaust pipe. The influence of leaks in the exhaust system or emissions console are investigated and evaluated in terms of the mathematical model. A.W.H.

N79-30191*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF TWO-STAGE FAN WITH A FIRST-STAGE ROTOR REDESIGNED TO ACCOUNT FOR THE PRESENCE OF A PART-SPAN DAMPER
William T. Gorrell and Donald C. Yrasek Sep. 1979 72 p refs
(NASA-TP-1483; E-9786; AVRADCOM-TR-79-10) Avail: NTIS HC A04/MF A01 CSCL 21E

The NASA two-stage fan was tested with a redesigned first-stage rotor. The redesign included a new design approach to account for the presence of a part-span damper. At design speed the fan achieved a peak efficiency of 0.803, which is 1.9 percentage points higher than the original design. The peak efficiencies of the first stage and first rotor were 0.789 and 0.821, respectively. An improvement in efficiency of up to 5 percentage points in the damper region was achieved over the original large damper version. The stall margin, based on flow conditions at peak efficiency, was 10 percent at design speed. Author

N79-30192# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abt. Technische Akustik.
NOISE GENERATION BY JET-ENGINE EXHAUST DEFLECTION
Burkhard Gehlhar, Werner Dobrzynski, and Bernhard Fuhrken Sep. 1978 56 p refs In German; ENGLISH summary Report will be also announced as translation (ESA-TT-553)
(DLR-FB-78-21) Avail: NTIS HC A04/MF A01; DFVLR, Cologne DM 23,30

Noise radiation by jet-engine exhaust-flow-interaction with blast deflectors was investigated by means of model-experiments of scale 0.1; the investigations pertained to a specific deflector configuration. Noise spectra and directivity characteristics for various power-settings and configuration changes were determined and used for the prediction of noise generation by full-scale configuration. The investigation shows that the particular deflected gives rise to higher noise levels than those of the corresponding engine noise alone, when the distance between exhaust nozzle and deflector is loss than 10 nozzle-diameters. Author (ESA)

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N79-30193*# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
VTOL CONTROLS FOR SHIPBOARD LANDING M.S. Thesis
Christopher Graham McMuldroch Aug. 1979 198 p refs
(Contract NGL-22-009-124)
(NASA-CR-162140; LIDS-TH-928) Avail: NTIS HC A09/MF A01 CSCL 01C

The problem of landing a VTOL aircraft on a small ship in rough seas using an automatic controller is examined. The controller design uses the linear quadratic Gaussian results of modern control theory. Linear time invariant dynamic models are developed for the aircraft, ship, and wave motions. A hover controller commands the aircraft to track position and orientation of the ship deck using only low levels of control power. Commands for this task are generated by the solution of the steady state linear quadratic gaussian regulator problem. Analytical performance and control requirement tradeoffs are obtained. A landing controller commands the aircraft from stationary hover along a smooth, low control effort trajectory, to a touchdown on a predicted crest of ship motion. The design problem is formulated and solved as an approximate finite-time linear quadratic stochastic regulator. Performance and control results are found by Monte Carlo simulations. K.L.

N79-30194*# Scientific Systems, Inc., Cambridge, Mass.
A STUDY OF THE APPLICATION OF SINGULAR PERTURBATION THEORY Final Report
Raman K. Mehra, Robert B. Washburn, Salim Sajan, and James V. Carroll Aug. 1979 339 p refs
(Contract NAS1-15113)
(NASA-CR-3167) Avail: NTIS HC A15/MF A01 CSCL 01C

A hierarchical real time algorithm for optimal three dimensional control of aircraft is described. Systematic methods are developed for real time computation of nonlinear feedback controls by means of singular perturbation theory. The results are applied to a six state, three control variable, point mass model of an F-4 aircraft. Nonlinear feedback laws are presented for computing the optimal control of throttle, bank angle, and angle of attack. Real Time capability is assessed on a TI 9900 microcomputer. The breakdown of the singular perturbation approximation near the terminal point is examined Continuation methods are examined to obtain exact optimal trajectories starting from the singular perturbation solutions. A.W.H.

N79-30195# Rockwell International Corp., Columbus, Ohio. Aircraft Div.
FLUIDICS: FEASIBILITY STUDY ELECTRO/HYDRAULIC/FLUIDIC DIRECT DRIVE SERVO VALVE Final Report, 11 Apr. - 29 Dec. 1978
Louis P. Biafore and Bernie Holland Washington NASC Mar. 1979 74 p refs
(Contract N62269-78-C-0176; WF41400000)
(AD-A069798; NR78H-126; NADC-78-033-60) Avail: NTIS HC A04/MF A01 CSCL 13/7

The feasibility of providing a fluidic back-up control for the Navy's Advanced flight control actuation system (AFCAS) was investigated and potential design concepts were evaluated. A prelim. spec. for an electro/hydraulic/fluidic direct drive servo valve was proposed. Technical data and supplier hardware was reviewed. A design concept for an electro/hydraulic/fluidic servo control valve was selected and a prelim. design drawing was prepared. The study confirms the feasibility of providing a fluidic back-up for the AFCAS direct drive servo valve. GRA

N79-30196# Boeing Vertol Co., Philadelphia, Pa.
EVALUATION OF PYLON FOCUSING FOR REDUCED HELICOPTER VIBRATION Final Report, Aug. 1977 - May 1978
R. Gabel and D. Reed Apr. 1979 96 p refs
(Contract DAAJ02-77-C-0034; DA Proj. 1L2-62209-AH-76)
(AD-A069712; D210-11390-1; USARTL-TR-79-6) Avail: NTIS HC A05/MF A01 CSCL 01/3

A wind tunnel model test program was conducted to investigate the effectiveness of a focused isolation system in reducing the transmission of rotor-induced vibratory loads for a four-bladed hingeless rotor. The model consisted of a four-bladed hingeless rotor and a simulated transmission mounted on a focal isolation system having pitch and roll degrees of freedom. Analytical considerations indicate that there is no single focus which will simultaneously isolate both hub moments and inplane loads. For the four-bladed hingeless rotor with large vibratory hub moments, the optimum focus lies close to the combined rotor/transmission center of gravity. Model test results indicated two configurations with reasonable moment isolation. One was an upward focus near the combined rotor/transmission center of gravity. The second, which had an effective downward focus, produced high lateral and longitudinal loads. GRA

N79-30197# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
AN IN-FLIGHT CONTROLLER INSENSITIVE TO PARAMETERS VARIATION
Gerhard Kreisselmeier and Reinhold Steinhauser May 1978 80 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-565)
(DLR-FB-78-07) Avail: NTIS HC A05/MF A01; DFVLR, Cologne DM 30.30

A design method, based on a systematic approach to aircraft attitude control parameters, was developed and tried on the design of a pitch controller for the Do28D Skyservant aircraft. The method takes into consideration the entire range of in-flight requirements posed by the guidance characteristics of the aircraft, including appropriate response (damping) to air turbulence. The controller is independent of radical changes in flight conditions and thus responds to the special problem of low speed elevator control as a harmonic progression of the elevator deflection angle. The influence of an onboard computer on flight behavior is examined and flight test results are compared with computer simulation results. Author (ESA)

N79-30198# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
THE GUIDANCE AND CONTROL OF HELICOPTERS AND V/STOL AIRCRAFT AT NIGHT AND IN POOR VISIBILITY
May 1979 237 p refs Partly in ENGLISH and FRENCH Papers presented at the Guidance and Control Panel Symp., The Hague, 9-12 Oct. 1978
(AGARD-CP-258; ISBN-92-835-0238-8) Avail: NTIS HC A11/MF A01

The following topics are discussed: (1) operational requirements; (2) controls and displays; (3) forward looking sensors; (4) man/machine aspects; (5) landing operations and systems; and (6) system implementation. For individual titles, see N79-30199 through N79-30217.

N79-30199# Army Training and Doctrine Command, Fort Monroe, Va.
ADDING THE CHALLENGE OF NAP-OF-THE-EARTH
Joseph C. Tirre *In* AGARD The Guidance and Control of Helicopters and V/STOL Aircraft at Night and in Poor Visibility May 1979 5 p (For primary document see N79-30198 21-08)
Avail: NTIS HC A11/MF A01

In an attempt to defy the law of physics as it pertains to having two or more bodies occupy the same space at the same time, NAP-of-the Earth (NOE) was developed. The problems of night, weather, and NOE flying discussed include: (1) navigation; (2) communication; (3) aircraft control; (4) wire detection; and (5) target acquisition/engagement. S.E.S.

N79-30200# Smiths Industries Ltd., Cheltenham (England).
THE DEVELOPMENT AND IN-FLIGHT EVALUATION OF A TRIPLEX DIGITAL AUTOSTABILIZATION SYSTEM FOR A HELICOPTER
J. Meadows and P. Robinson (RAE, Farnborough, Engl.) *In* AGARD The Guidance and Control of Helicopters and V/STOL Aircraft at Night and in Poor Visibility May 1979 22 p refs (For primary document see N79-30198 21-08)
Avail: NTIS HC A11/MF A01

The program and the triplex autostabilization system and its installation in the aircraft were reviewed. The final stages of development, with particular emphasis on the major contribution afforded by a comprehensive systems rig, both to the hardware and software development program are discussed. The results of in-flight evaluation program including performance under fault-free and simulated runaway conditions. A number of problem areas encountered during the initial phases of the flight trials and means to overcome these are presented. S.E.S.

N79-30201# Marconi-Elliott Avionic Systems Ltd., Rochester (England).
SOME ASPECTS OF THE DESIGN AND DEVELOPMENT OF THE MARITIME AUTOPILOT MODES FOR THE WESTLAND LYNX HELICOPTER
K. S. Snelling and M. V. Cook (Cranfield Inst. of Technol.) *In* AGARD The Guidance and Control of Helicopters and V/STOL Aircraft at Night and in Poor Visibility May 1979 18 p refs (For primary document see N79-30198 21-08)
Avail: NTIS HC A11/MF A01

The stability augmentation system and the transistion autopilot mode were reviewed. The requirement for Sea State filtering of the height control signal is discussed. The design and development of the Cable Angle and Cable Height hold autopilot modes that together provide sonar modes for stabilizing the position of a dunking sonar. S.E.S.

N79-30202*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DESIGN AND TESTING OF A REDUNDANT SKEWED INERTIAL SENSOR COMPLEX FOR INTEGRATED NAVIGATION AND FLIGHT CONTROL
R. E. Ebner (Litton Systems, Inc., Woodland Hills, Calif.) and W. E. Howell *In* AGARD The Guidance and Control of Helicopters and V/STOL Aircraft at Night and in Poor Visibility May 1979 13 p refs (For primary document see N79-30198 21-08)
Avail: NTIS HC A11/MF A01 CSCL 01C

Requirements for a redundant strapdown inertial sensor complex applied to V/STOL aircraft as developed by NASA are presented. Flight test data of a redundant, skewed axis strapdown inertial system are given, demonstrating the feasibility of the primary design aspects. This data consisted of parity equation responses through various flight conditions, showing residual noise levels on redundant gyro and accelerometer comparisons as a measure of minimum failure-level detectability, plus failure isolation and navigation performance through several simulated instrument failures. S.E.S.

N79-30203# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
SCAN CONVERTER AND RASTER DISPLAY CONTROLLER FOR NIGHT VISION DISPLAY SYSTEMS
H. W. Killian and W. Voswinckel *In* AGARD The Guidance and Control of Helicopters and V/STOL Aircraft at Night and in Poor Visibility May 1979 10 p (For primary document see N79-30198 21-08)
Avail: NTIS HC A11/MF A01

A modular Raster Display System and its functional modules are described. Digital scan conversion of images of electro-optical sensors and digital storage of images with several gray tones are allowed. With the help of the digital symbol generator digital

information is converted into adequate symbology which again can be superimposed on the sensor image. Superposition of two sensor images is performed with the same equipment. Some technical features are discussed which exceed the common modes of current display systems and may help to support missions of military helicopters flying low level at poor visibility conditions. S.E.S.

N79-30204# Army Avionics Research and Development Activity, Fort Monmouth, N. J.
APPLICATIONS OF PATTERN RECOGNITION SYSTEMS FOR DAY/NIGHT PRECISION AIRCRAFT CONTROL
Alfred Kleider *In* AGARD The Guidance and Control of Helicopters and V/STOL Aircraft at Night and in Poor Visibility May 1979 7 p refs (For primary document see N79-30198 21-08)
Avail: NTIS HC A11/MF A01

The philosophical and practical foundations for the utilization of advanced technological developments in lasers and Charge Coupled Devices (CCD) to provide light weight, low cost solutions to theise problems in day/night operations are explored. The special case of weather limited visibility is presented and projected operational parameters are discussed relative to near term availability of infrared devices (IRCCD). The concept of feature extraction is explored using the complimentary one dimensional characteristics of wire/wire-like obstacles and a 1728 linear CCD Array as the foundation of the Wire Obstacle Warning System (WOWS) presently in development. In this instance the appropriate geometrical, optical, and electronic capatibilities were combined to provide a real time automatic pattern recognition system for Nap-of-the-Earth (NOE) helicopter operations. S.E.S.

N79-30205# Army Avionics Research and Development Activity, Fort Monmouth, N. J.
HETERODYNING CO2 LASER RADAR FOR AIRBORNE APPLICATIONS
R. L. DelBoca and R. J. Mongeon (United Technol. Res. Center) *In* AGARD The Guidance and Control of Helicopters and V/STOL Aircraft at Night and in Poor Visibility May 1979 17 p refs (For primary document see N79-30198 21-08)
Avail: NTIS HC A11/MF A01

The design considerations, hardware configuration, and test results of flyable breadboard models are discussed which have demonstrated the feasibility of employing CO2 scanning laser systems for wire detection, precision hover, Doppler navigation, and terrain following. S.E.S.

N79-30206# Standard Elektrik Lorenz A.G., Stuttgart (West Germany).
A SELF CONTAINED COLLISION AVOIDANCE SYSTEM FOR HELICOPTERS
S. Bloch, G. Hoefgen, and D. zurHeiden *In* AGARD The Guidance and Control of Helicopters and V/STOL Aircraft at Night and in Poor Visibility May 1979 6 p refs (For primary document see N79-30198 21-08)
Avail: NTIS HC A11/MF A01

A proposed solution to the problem of obstacle detection and collision warning pertaining to the operation of helicopters at low altitude and within a formation is described. A simple yet effective algorithm is used in order to assess the collision hazard posed by stationary obstacles as well as other helicopters in the proximity of the protected aircraft. The raw data needed (range and closing speed) is provided by a 35 GHz versatile low-cost FM/CW-radar that was originally developed for the protection of road vehicles. With the exception of the antenna assembly only minor modifications are needed in order to make this radar fit the requirements of an airborne anti-collision system. Author

N79-30207# Ferranti Ltd., Edinburgh (Scotland). Radar Group.
A HELICOPTER HIGH DEFINITION ROTOR BLADE RADAR
C. M. Steward *In* AGARD The Guidance and Control of Helicopters and V/STOL Aircraft at Night and in Poor Visibility May 1979 10 p ref (For primary document see N79-30198 21-08)
Avail: NTIS HC A11/MF A01

By installing a radar aerial within the rotor blade, a sensor having unique capabilities for the operation of helicopters in darkness or bad weather can be provided. A description of such a system is given outlining the factors affecting the choice of the principal radar parameters and their interaction with the helicopter rotor design. Examples of the high definition pictures from the display are shown with the appropriate section of map for comparison and some suggestions are made on operational roles where such a radar system would have particular advantages. Author

N79-30208# Naval Air Development Center, Warminster, Pa.
DESIGN PROCEDURE FOR AIRCREW STATION LABELING SELECTION AND ABBREVIATION
Patrick M. Curran and Norman E. Lane *In* AGARD The Guidance and Control of Helicopters and V/STOL Aircraft at Night and in Poor Visibility May 1979 16 p refs (For primary document see N79-30198 21-08)
Avail: NTIS HC A11/MF A01

Methods are described of preparing the functional statements of what, where, when, and how the operator should act upon gathering information on a characteristic of a system/subsystem or component. The usage of common labeling of associated controls and displays is presented as well as specific procedures for abbreviating display/control labels. M.M.M.

N79-30209# Royal Aircraft Establishment, Farnborough (England). Flight Systems Dept.
SUBJECTIVE ASSESSMENT OF A HELICOPTER APPROACH SYSTEM FOR IFR CONDITIONS
H. Howells *In* AGARD The Guidance and Control of Helicopters and V/STOL Aircraft at Night and in Poor Visibility May 1979 7 p refs (For primary document see N79-30198 21-08)
Avail: NTIS HC A11/MF A01

The contribution of subjective assessment techniques used in the flight evaluation of 3 azimuth approach guidance laws presented on crosspointers of electromechanical instruments in a fully stabilized helicopter is outlined. The pilots were instructed to confine their attention to monitoring the instruments within the cockpit as a safety pilot was carried. The use of subjective assessment techniques, in conjunction with the interpretation of radar plots and comments of an airborne trials observer, provide a type of information not obtainable from other sources. The technique, although used here on electromechanical instruments, would be equally applicable to an assessment of electro-optical displays. M.M.M.

N79-30210# Army Avionics Research and Development Activity, Fort Monmouth, N. J.
THE IMPACT OF A MULTI-FUNCTION PROGRAMMABLE CONTROL DISPLAY UNIT IN AFFECTING A REDUCTION OF PILOT WORKLOAD
Bernard S. Gurman *In* AGARD The Guidance and Control of Helicopters and V/STOL Aircraft at Night and in Poor Visibility May 1979 8 p refs (For primary document see N79-30198 21-08)
Avail: NTIS HC A11/MF A01

Three digitally-addressed Multi-Legend Display Switches (MLD/S) which employ different mechanizations, and the incorporating of these MLD/S's in a multi-purpose, programmable Control Display Unit (CDU) are described. Several programs are cited which logically led to the development of the Multi-Legend Display Switches and the CDU. These programs and that possible applications are presented. Developments that lead to the reduction of pilot workload and improve overall pilot/vehicle performance are pointed out. M.M.M.

N79-30211# GIE ISPENA, Paris (France).
THE EQUIPMENT-SYSTEM INTERFACE IN AN ANTITANK HELICOPTER AT NIGHT [ETUDE D'INTERFACE EQUIPAGE SYSTEME DANS UN HELICOPTERE ANTI-CHAR DE NUIT]
G. Ferlet and J. L. Mascle *In* AGARD The Guidance and Control of Helicopters and V/STOL Aircraft at Night and in Poor Visibility May 1979 10 p In FRENCH (For primary document see N79-30198 21-08)
Avail: NTIS HC A11/MF A01

A direct consequence of the growing complexity of modern aircraft missions is the increase of equipment workloads, which

can reach a critical level in many cases. It is important to consider this problem from the beginning of the aircraft definition stage so that some really integrated solutions which guarantee maximum operational efficiency can be proposed for the equipment-system interface. Such a step requires the adoption of a rigorous, systematic work method that is capable of accounting for diverse data such as technological constraints or operational requirements, in order to obtain optimal solutions. A methodology used in the study of the equipment-system interface for an antitank helicopter capable of performing its mission by day as well as by night is presented. The technique distinguishes five stages in the iterative process, thus permitting progressive improvement in the definition of the interface, as a function of the difficulties considered at different stages. Transl. by A.R.H.

N79-30212# Naval Air Systems Command, Washington, D. C. Advanced Aircraft Development and Systems Objectives Office.

PROJECT NAVTOLAND (NAVY VERTICAL TAKEOFF AND LANDING CAPABILITY DEVELOPMENT)

Thomas S. Momiyama *In* AGARD The Guidance and Control of Helicopters and V/STOL Aircraft at Night and in Poor Visibility May 1979 20 p refs (For primary document see N79-30198 21-08)

Avail: NTIS HC A11/MF A01

The U.S. Navy's integrated systems approach to improve the helicopter and fixed-wing VSTOL aircraft operational capabilities at sea and in tactical sites is described. The current capability is limited to generally 400 foot ceiling and one mile visibility to 200 foot and 1/2 mile weather minima due to elementary flight control systems or lack of precision approach and landing guidance. Inability to cope with ship motions limits the small air capable ship operations generally to Sea State 3. The NAVTOLAND project goals are zero ceiling and 1/8 mile visibility weather minima and Sea State 5 operation. An integrated development of the aircraft flight control and display systems to provide flying qualities with satisfactory level of pilot workload and the shipboard and tactical site installed guidance systems and visual landing aids to effect precision in touchdown is applied toward improvement of the helicopter and AV-8 HARRIER operations and toward development of all-weather and rough sea operations of all future Navy and Marine Corps VSTOL aircraft. M.M.M.

N79-30213# Bodenseewerk Geraetetechnik G.m.b.H., Ueberlingen (West Germany).

GCU, THE GUIDANCE AND CONTROL UNIT FOR ALL WEATHER APPROACH

Hartmut Boehret *In* AGARD The Guidance and Control of Helicopters and V/STOL Aircraft at Night and in Poor Visibility May 1979 11 p refs (For primary document see N79-30198 21-08)

Avail: NTIS HC A11/MF A01

The guidance and control unit GCU development by Bodenseewerk and sponsored by the German Ministry of Defense, demonstrated in flight test the improvements of future landing procedures. The short-captured steep approach paths generated by the GCU can be flown manually with the flight director instrument due to the high accuracy of signal processing by means of Kalman filter techniques. The technical equipment is presented and the flight test results are discussed. M.M.M.

N79-30214# McDonnell-Douglas Corp., St. Louis, Mo. Electronics Branch.

SIMULATION AND STUDY OF V/STOL LANDING AIDS FOR USMC AV-8 AIRCRAFT

W. E. Bode, R. A. Kendrick, and E. J. Kane *In* AGARD The Guidance and Control of Helicopters and V/STOL Aircraft at Night and in Poor Visibility May 1979 16 p (For primary document see N79-30198 21-08)

Avail: NTIS HC A11/MF A01

Motion base simulations, flown by USMC Harrier pilots, in which 600 low speed IFR approaches to a forward site and ship were made. Glideslope angles from 3 degrees to 9 degrees were simulated and flown both head up and head down. An attitude hold autopilot was evaluated and flight director steering was studied. The effects of crosswind, turbulence, sea state and system errors were included in the simulation. Visual landing aids for ships and forward sites were devised and aircraft and ground/ship based equipment selected. At the heart of the study was the evaluation by the pilots of the degree of improvement offered by the simulated landing aids. M.M.M.

N79-30215# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).

IMPLEMENTATION OF FLIGHT CONTROL IN AN INTEGRATED GUIDANCE AND CONTROL SYSTEM

H. J. Bangen, W. Hoffmann, and W. Metzdorff *In* AGARD The Guidance and Control of Helicopters and V/STOL Aircraft at Night and in Poor Visibility May 1979 11 p refs (For primary document see N79-30198 21-08)

Avail: NTIS HC A11/MF A01

The hardware and software technology is presented as it is required to solve the control problem in the integrated helicopter guidance and control system. M.M.M.

N79-30216# Societe de Fabrication d'Instruments de Mesure SFIM, Massy (France).

STABILIZING ELECTRO-OPTICAL SYSTEMS ON HELICOPTERS [STABILISATION DES SYSTEMES ELECTRO-OPTIQUES SUR HELICOPTERES]

Dominique dePonteves *In* AGARD The Guidance and Control of Helicopters and V/STOL Aircraft at Night and in Poor Visibility May 1979 5 p In FRENCH; ENGLISH summary (For primary document see N79-30198 21-08)

Avail: NTIS HC A11/MF A01

The stabilization of both the APX-BEZU M260 gyrostabilized sights used for surveillance and the aiming of antitank missiles, and the APX M397 sight, used with an IR goniometer to aim the HOT missile, is implemented by a mechanical relation between a mirror and a conventional gyro. The development of infrared sensors needing large optical aperture led to the design and implementation of a two-axis, tuned gyro which can be used either as a free gyro or as a rate gyro. Its performance allows the stabilization of the most performing optical sensors with a MTF degradation of not more than 15 percent. Preliminary flight tests were performed on an electro-optical system which combines a TV camera with a very high focal length, a laser range finder, and a twin-focal FLIR in order to determine its feasibility for aiming a weapon aiming system suing 8 to 13 microns band. Transfer functions are discussed. A.R.H.

N79-30217# Rockwell International Corp., Cedar Rapids, Iowa. Collins Government Avionics Div.

AN ADVANCED GUIDANCE AND CONTROL SYSTEM FOR RESCUE HELICOPTERS

Kenneth W. McElreath *In* AGARD The Guidance and Control of Helicopters and V/STOL Aircraft at Night and in Poor Visibility May 1979 17 p (For primary document see N79-30198 21-08)

Avail: NTIS HC A11/MF A01

After identifying the tasks in accomplishing a search and rescue mission, Rockwell-Collins established guidelines and priorities for designing and integrating the system elements. The development of the avionics system architecture is reported and the features of each element which contribute to the adverse weather capability of the integrated system are described. M.M.M.

N79-30218# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).

STABILITY AND CONTROL

May 1979 359 p refs In ENGLISH and FRENCH Presented at the Flight Mech. Panel Symp. on Stability and Control, Ottawa, 25-28 Sep. 1978

(AGARD-CP-260; ISBN-92-835-0239-6) Avail: NTIS HC A16/MF A01

The fundamental relationship between the use of advanced control concepts and appropriate aircraft design is considered. Experiences in stability and control, the application of active control and the general problems concerning its use, including those of mathematical models, and results obtained with control configured vehicles are discussed. Criteria for satisfactory behavior of aircraft with advanced stability and control systems and the participation of the pilot are included. For individual titles, see N79-30219 through N79-30243.

N79-30219*# National Aeronautics and Space Administration, Washington, D. C.
SYSTEMS IMPLICATIONS OF ACTIVE CONTROLS
Peter R. Kurzhals *In* AGARD Stability and Control May 1979 16 p refs (For primary document see N79-30218 21-08)
Avail: NTIS HC A16/MF A01

Control configured vehicle design and system considerations are outlined and representative applications of active control for fighter and transport aircraft are summarized. Specific examples include relaxed static stability and angle of attack limiting on the F-16, envelope limiting and ride smoothing on the F-8, maneuver load and control and relaxed static stability on the L-1011, load alleviation for the C-5, and B-1 ride control. Principal features, problem areas, and mechanization trends for these and projected future active control applications are outlined. J.M.S.

N79-30220# Lockheed Missiles and Space Co., Sunnyvale, Calif.
A SUMMARY OF AGARD FDP MEETING ON DYNAMIC STABILITY PARAMETERS
L. E. Ericsson *In* AGARD Stability and Control May 1979 23 p refs (For primary document see N79-30218 21-08)
Avail: NTIS HC A16/MF A01

Wind tunnel and flight testing techniques, analytical techniques, including motion analysis and nonlinear formulations were covered along with sensitivity and simulator studies to assess the importance of the various dynamic stability parameters, including cross coupling effects between lateral and longitudinal degrees of freedom. The extent to which the practice of decoupling lateral and longitudinal degrees of freedom must be abandoned was addressed. It was decided that when describing the vehicle dynamics of advanced aircraft and aerospace vehicles, which perform sustained operations at high angles of attack, the cross coupling effects are usually significant, and lateral and longitudinal degrees of freedom must be considered together. J.M.S.

N79-30221# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
STRUCTURAL ASPECTS OF ACTIVE CONTROLS
Roger Destuynder *In* AGARD Stability and Control May 1979 12 p refs In FRENCH; ENGLISH summary (For primary document see N79-30218 21-08)
Avail: NTIS HC A16/MF A01

Various papers presented at the specialists meeting sponsored by the Structures and Materials Panel in Lisbon (1977) are summarized. Emphasis is placed on the following main points: (1) the use of preliminary simple calculations to cover the different configurations and the possible control laws; (2) improvement with the help of corrections obtained by wind tunnel tests; and (3) proof, through flight test or wind tunnel test, of the validity of the solution. Progress in flutter suppression obtained at ONERA is also reported. A.R.H.

N79-30222# British Aerospace Dynamics Group, Bristol (England). Theoretical Studies Dept.
CONTROL OF MISSILE AIRFRAMES
Derek J. Frary *In* AGARD Stability and Control May 1979 16 p refs (For primary document see N79-30218 21-08)
Avail: NTIS HC A16/MF A01

The main differences between manned aircraft and missiles and the approach to the design of missile airframe control systems is presented. The requirements placed on airframe control loops by guidance systems are described to illustrate the advantages of using a neutrally stable airframe. Various airframe control systems in current use are reviewed, showing how active control technology is applied to missile systems. Design factors such as body flexure and nonlinearities are discussed. Also included is a brief description of some typical airframe control systems and avionics loops which are used for unmanned aircraft. J.M.S.

N79-30223# General Dynamics/Fort Worth, Tex.
ENHANCED FIGHTER MISSION EFFECTIVENESS BY USE OF INTEGRATED FLIGHT SYSTEMS
John H. Watson and Willie S. Bennett *In* AGARD Stability and Control May 1979 13 p refs (For primary document see N79-30218 21-08)
Avail: NTIS HC A16/MF A01

The performance of the modern fighter aircraft and its flight systems is discussed. Improvement in effectiveness through proper functional integration of the pilot, his crew station, and the flight systems is emphasized. The incorporation of advanced control modes, the integration of avionic systems and the flight control systems, and the unification of all aircraft functions under the control of a flight management system are among the factors considered. J.M.S.

N79-30224# Societe Nationale Industrielle Aerospatiale, Toulouse (France).
RESULTS RELATED TO SIMULATED AND IN-FLIGHT EXPERIMENTATION WITH AN ELECTRIC FLIGHT CONTROL SYSTEM THAT CAN BE GENERALIZED [RESULTATS RELATIFS A L'EXPERIMENTATION SUR SIMULATEUR ET EN VOL D'UN SYSTEME DE COMMANDES DE VOL ELECTRIQUES GENERALISABLES]
A. Cazenave and J. Irvoas *In* AGARD Stability and Control May 1979 21 p In FRENCH (For primary document see N79-30218 21-08)
Avail: NTIS HC A16/MF A01

Studies of the performance of a transport aircraft with slender airfoils whose longitudinal stability is assured by the use of elevators show the advantage of moving back the center of gravity in order to improve finesse at low speeds; the optimal centering is located beyond the operationally acceptable rear limit for handling with classical flight controls. An electric flight control system which permits control under conditions of pronounced instability across the control stick was designed, used in a simulator, and then flight tested on the T.S.S. Concorde. The form of the control laws considered is described as well as the improvements made after the simulation. Characteristics and the results obtained in flight are presented and compared to predictions. Transl. by A.R.H.

N79-30225# Northrop Corp., Hawthorne, Calif. Aircraft Corp.
IMPROVEMENT OF FIGHTER AIRCRAFT MANEUVERABILITY THROUGH EMPLOYMENT OF CONTROL CONFIGURED VEHICLE TECHNOLOGY
Janusz Stalony-Dobrzanski and Naren Shah *In* AGARD Stability and Control May 1979 22 p refs (For primary document see N79-30218 21-08)
Avail: NTIS HC A16/MF A01

The control configured vehicle (CCV) design concept employing concurrently the traditional disciplines as well as full authority automatic control system design, is shown to offer a very large combat performance improvement over conventional design approach. This improvement is due primarily to the freedom, under CCV concept, of designing statistically longitudinally unstable configurations. The configuration selected for the evaluation is a tailless clipped delta employing advanced structure and engine technologies. The performance gains are achieved simultaneously with decreased aircraft and fuel weight for the same mission. The feasibility of designing a stability and command augmentation (SCAS) for the statically unstable configurations is demonstrated. The full authority SCAS provides excellent flying qualities in general flying and target tracking modes. The departure prevention feature permits true 'head-out-of-cockpit' flying without the pilot having ever to consult flight instruments for safety. The system was evaluated extensively on a moving base simulator. The practical limitations to the degree of static instability are discussed. J.M.S.

N79-30226# Royal Aircraft Establishment, Farnborough (England). Flight Systems Dept.
LATERAL STABILITY AT HIGH ANGLES OF ATTACK, PARTICULARLY WING ROCK
A. Jean Ross *In* AGARD Stability and Control May 1979 19 p refs (For primary document see N79-30218 21-08)
Avail: NTIS HC A16/MF A01

The Gnat aircraft exhibits wing rock at high subsonic Mach numbers, but the onset of wing rock is delayed to higher angles of attack if fuel tanks are carried on the wings. Flight responses of Dutch roll and wing rock oscillations in steady turns were analyzed to give the variation of the stability derivatives with angles of attack at various Mach numbers for both aircraft configurations. The results show that the onset of wing rock occurs when the damping of the Dutch roll mode is zero, due mainly to loss in damping-in-roll derivative at high angle of attack. The stability derivatives from flight tests were compared

with wind tunnel results, and show the same trends with angle of attack. The values of the linear derivatives were used as a basis for evaluating the effects of various added aerodynamic nonlinearities, both to explore the possible mechanisms for the limit cycle type of wing rock responses, and to calculate the changes in response due to an idealized stability augmentation system. Author

N79-30227# Hochschule der Bundeswehr, Munich. (West Germany).
STALL BEHAVIOUR EVALUATION FROM FLIGHT TEST RESULTS
G. Sachs and H. Wuennenberg (Dornier-Werke G.m.b.H., Friedrichshafen) *In* AGARD Stability and Control May 1979 9 p refs (For primary document see N79-30218 21-08)
Avail: NTIS HC A16/MF A01

By comparing the dynamic stall behavior of a combat aircraft with a simulation, a special type of discrepancy in roll was found. The simulation was based on the best wind tunnel data available. The examination leads to the conclusion, that the aircraft is disturbed by random-type 'fluctuation' forces and moments. The order of magnitude was estimated from the scattering region of the wind tunnel data beyond C sub L max. By introducing these effects into the mathematical model it was possible to simulate the pilot in the loop dynamic stall behavior with the aid of a simple mathematical pilot model. For a general application in the design stage of a new project, new wind tunnel test techniques including the measurement of the time dependent parameters will be necessary. Author

N79-30228# Marconi-Elliott Avionic Systems Ltd., Rochester (England). Flight Controls Div.
HYBRID COMPUTER INVESTIGATION OF DISCRETE GUST AND WINDSHEAR EFFECTS ON AUTOMATIC LANDING SYSTEM PERFORMANCE
K. W. Rosenberg *In* AGARD Stability and Control May 1979 14 p refs (For primary document see N79-30218 21-08)
Avail: NTIS HC A16/MF A01

A hybrid computer investigation is described which includes a search routine which allows the gust parameters and point of application of the gust to be varied so that the limiting touchdown range and vertical velocity for a given gust intensity can be determined. The results are discussed and compared with the performance assessment using conventional certification criteria. The feasibility of this method as a general design tool for flight control systems is also discussed. Author

N79-30229# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
AIRCRAFT RESPONSE TO WINDSHEARS AND DOWN-DRAUGHTS
J. C. vanderVaart *In* AGARD Stability and Control May 1979 16 p refs (For primary document see N79-30218 21-08)
Avail: NTIS HC A16/MF A01

After a short review of current methods of modelling low altitude random atmospheric turbulence and variations of mean wind with altitude (windshears), a description is given of an analytical method to find deterministic wind or turbulence time histories that cause largest deviations of aircraft motion variables. Some numerical examples illustrate that small variations of wind, in particular of horizontal wind, may cause relatively large deviations relative to a desired aircraft trajectory. Finally, it is shown that the problem of finding 'worst case' response to deterministic changes in wind can be reduced to that of the statistics of a random white noise driven linear system. Author

N79-30230# Aeritalia S.p.A., Torino (Italy). Combat Aircraft Group.
GUST ALLEVIATOR FEASIBILITY STUDY FOR G91Y
R. Carabelli *In* AGARD Stability and Control May 1979 12 p ref (For primary document see N79-30218 21-08)
Avail: NTIS HC A16/MF A01

A feasibility study was carried out of an active system to alleviate the turbulence effects on a light attack aircraft during the penetration phase of a ground attack mission. The study was tailored to the G91Y and the conclusions were that proceeding through an experimental research by developing a flying prototype would be preferable. The risks implicit in the achievement of the required accuracy in measuring the gust velocity were very high. The proposed system works on two axes. An open loop subsystem driven by the normal component of the gust velocity on the pitch axis and a roll damper on the lateral is indicated as an adequate solution to meet profitable cockpit 'g' reductions and weapon delivery accuracy improvement as well. R.E.S.

N79-30231# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
DESIGN CONSIDERATIONS FOR RELIABLE FBW FLIGHT CONTROL
James K. Ramage and James W. Morris *In* AGARD Stability and Control May 1979 15 p refs (For primary document see N79-30218 21-08)
Avail: NTIS HC A16/MF A01

Critical design considerations which both aircraft designers and flight control systems engineers must bear in mind in the design and implementation of fly by wire flight control systems are presented. R.E.S.

N79-30232# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.
OPEN/CLOSED LOOP IDENTIFICATION OF STABILITY AND CONTROL CHARACTERISTICS OF COMBAT AIRCRAFT
R. Koehler and M. Marchand *In* AGARD Stability and Control May 1979 11 p (For primary document see N79-30218 21-08)
Avail: NTIS HC A16/MF A01

General aspects of assessing flying qualities of augmented aircraft using system identification methods are discussed. The aircraft under test was equipped with a stability augmentation system which had a complex dynamic behavior. The dynamics influenced the flying qualities as well as the applicability of investigation methods. Therefore, the influence and recognizability of the stability augmentation system dynamics on handling quality evaluations and system identifications were inquired and pilot-in-the-loop investigations were made using the system identification results. R.E.S.

N79-30233# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.
DYNAMIC WINDTUNNEL SIMULATION OF ACTIVE CONTROL SYSTEMS
P. G. Hamel and B. Krag *In* AGARD Stability and Control May 1979 10 p refs (For primary document see N79-30218 21-08)
Avail: NTIS HC A16/MF A01

Research studies were conducted to demonstrate the application potential of dynamic simulation in a wind tunnels test facility. Elastic mode control and ride smoothing systems were scaled to model frequency and tested in a 3 m subsonic gust windtunnel. An open loop active control ride smoothing system was optimized for the Dornier-TNT light transport aircraft experimental program. Dynamic wind tunnel flight tests of this program were successfully completed. R.E.S.

N79-30234# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Military Aircraft Div.
STABILITY AND CONTROL ASPECTS OF THE CCV-F104C
H. Beh, U. Korte, and G. Loebert *In* AGARD Stability and Control May 1979 18 p refs (For primary document see N79-30218 21-08)
Avail: NTIS HC A16/MF A01

The control configured vehicle and its implementation, and the design of the control laws are described. The superior flight performance of the control configured vehicle-flight control system is compared with that of the basic F 104G on the basis of simulator results. The validity of these results was demonstrated by comparison of the principal characteristics of longitudinal and lateral motion measured in flight with the corresponding predicted values. R.E.S.

N79-30235# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
DESIGN GUIDANCE FROM FIGHTER CCV FLIGHT EVALUATIONS

Frank R. Swortzel and Jack D. McAllister (Gen. Dyn./Ft. Worth, Tex.) *In* AGARD Stability and Control May 1979 21 p refs (For primary document see N79-30218 21-08)
Avail: NTIS HC A16/MF A01

Flight control of the Fighter Control Configuration Vehicle (CCV) marked the first exploitation of six degree-of-freedom flight control concepts for a new way to fly. An 87 flight, 125 flight hour test was conducted on a modified YF-16. Validation of the new control concepts was accomplished and significant capabilities to improve overall mission effectiveness of fighter aircraft were demonstrated. The program also included pilot evaluation of the CCV control modes applied to air-to-air and air-to-ground mission oriented tasks. Resulting control features included direct force control, independent fuselage aiming and translation, maneuver enhancement and gust alleviation. Performance benefits of relaxed static stability were also evaluated. G.Y.

N79-30236# Lockheed-California Co., Burbank.
L-1011 ACTIVE CONTROLS, DESIGN PHILOSOPHY AND EXPERIENCE
David M. Urie *In* AGARD Stability and Control May 1979 9 p refs (For primary document see N79-30218 21-08)
Avail: NTIS HC A16/MF A01

Aircraft active control can be defined as control effectors activated by sensors through computers without pilot commands. A certificated commercial transport airplane, the Lockheed L-1011, currently employs several highly sophisticated systems satisfying this definition. The experience gained through development flight testing, commercial flight operation, and flight simulation research on active control applications is presented with the intent of relating design philosophy and results. G.Y.

N79-30237# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.
IN-FLIGHT HANDLING QUALITIES INVESTIGATION OF VARIOUS LONGITUDINAL SHORT TERM DYNAMICS AND DIRECT LIFT CONTROL COMBINATIONS FOR FLIGHT PATH TRACKING USING DFVLR HFB 320 VARIABLE STABILITY AIRCRAFT
D. Hanke and H.-H. Lange *In* AGARD Stability and Control May 1979 10 p refs (For primary document see N79-30218 21-08)
Avail: NTIS HC A16/MF A01

An in-flight investigation of DLC for wide body transport aircraft was carried out using DFVLR 320 variable stability aircraft which incorporates an advanced all digital model following system. The aircraft/DLC configuration parameters was investigated in an altitude compensatory tracking task in which the pilot has to minimize the error between commanded and actual altitude. To determine the influence of motion cues, the tracking task is carried out both on the ground and in-flight. Using the HFB 320 as a fixed base and an in-flight simulator, an ideal situation for comparing the fixed base and in-flight simulation results exists. In addition pilot-in-the-loop analysis for flight path tracking with DLC is performed. The results are given in the form of subjective pilot effort ratings and pilot-aircraft performance measures. The results are further compared with a flight path tracking criterion. G.Y.

N79-30238# British Aerospace Aircraft Group, Warton (England).
FLYING QUALITIES AND THE FLY-BY-WIRE AEROPLANE
J. C. Gibson *In* AGARD Stability and Control May 1979 8 p refs (For primary document see N79-30218 21-08)
Avail: NTIS HC A16/MF A01

The tornado flight control system was designed to give good stability, damping, and resistance to external disturbances. This was achieved by optimization of feedback gains and filters. Response to pilot inputs was then shaped by stick commands gains and filters. This process resulted in generally excellent flying qualities. Pilots reported a high level of confidence inspired by the easy and precise control with extremely good circuit handling and instrument flight characteristics. However, some deficiencies were noted associated in some cases with nonaircraft-like responses and these were eliminated by modifications to the command shaping. This experience emphasized that a specification which ensures entirely satisfactory flying qualities does not exist. Several areas where requirements are deficient or absent are illustrated. G.Y.

N79-30239# Naval Air Systems Command, Washington, D. C.
ARE TODAY'S SPECIFICATIONS APPROPRIATE FOR TOMORROW'S AIRPLANES?
R. C. AHarrah, W. J. Lamanna (McDonnell Aircraft Co., St. Louis, Mo.), and J. Hodgkinson *In* AGARD Stability and Control May 1979 12 p refs (For primary document see N79-30218 21-08)
Avail: NTIS HC A16/MF A01

An approach for taking any system of a higher order that is addressed in the current specifications, and producing an equivalent system of an appropriate order, which is directly relatable to the specification parameters is presented. Example applications of the equivalent systems approach to various higher order systems are presented; the insights of this approach to the newest fighter aircraft design are discussed; and very preliminary results are presented on a flight program which investigates equivalent systems. G.Y.

N79-30240# National Aerospace Lab., Amsterdam (Netherlands).
A SIMULATOR INVESTIGATION OF HANDLING QUALITY CRITERIA FOR CCV TRANSPORT AIRCRAFT
H. A. Mooij, W. P. deBoer, and M. F. C. vanGool *In* AGARD Stability and Control May 1979 14 p refs Sponsored in cooperation with Netherlands Agency for Aerospace Programs and Dept. of Civil Aviation of the Netherlands (For primary document see N79-30218 21-08)
Avail: NTIS HC A16/MF A01

The introduction of CCV (Control Configured Vehicle) concepts in the design of certain categories of future transport aircraft requires definition of handling quality criteria for such aircraft. These criteria should be applicable to guidance in flight control system design as well as in airworthiness certification. In an attempt to contribute new insight in this matter, approach and landing flight simulation investigations were performed using a moving base flight simulator. The conceptual aircraft was a jet transport aircraft developed around the relaxed static stability concept and equipped with a primary flight control system of the rate-command/attitude-hold type for pitch and roll control. Based on measured pilot/aircraft performance, pilot ratings and pilot commentary, boundary values for satisfactory handling qualities for the parameters investigated were established. G.Y.

N79-30241# National Aerospace Lab., Amsterdam (Netherlands).
MATHEMATICAL MODELS OF MANNED AEROSPACE SYSTEMS
P. H. Wewerinke *In* AGARD Stability and Control May 1979 8 p refs (For primary document see N79-30218 21-08)
Avail: NTIS HC A16/MF A01

Mathematical models of human operator's participation in manned aerospace systems are reviewed. Pilot's functioning is described in terms commensurate with those used for other system elements. This is desirable in order to deal with the complex interaction between pilot-related and task-related characteristics. The result is an integrated model of the man-machine system serving as a diagnostic tool (for existing systems) and allowing the extrapolation to new situations. G.Y.

N79-30242# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ONERA'S MODEL OF THE PILOT IN DISCRETE TIME [LE MODELE DE PILOTE EN TEMPS DISCRET DE L'ONERA]
Daniel Cavalli *In* AGARD Stability and Control May 1979 11 p refs In FRENCH (For primary document see N79-30218 21-08)
Avail: NTIS HC A16/MF A01

Numerical simulation of pilot performance provides a tool for evaluating the efficiency of pilot-aircraft systems and permits the study of the handling quality of new aircraft from the concept stage. Pilot performance is considered as a discreet time process in which decision making has a sequential character. The development of the ONERA model is described and its originality demonstrated by comparison with already existing models. Results obtained during application of the model in a study of performance degradation when the static margins of the simulated aircraft were decreased are presented. Transl. by A.R.H.

N79-30243*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FLIGHT EXPERIENCE WITH ADVANCED CONTROLS AND DISPLAYS DURING PILOTED CURVED DECELERATING APPROACHES IN A POWERED-LIFT STOL AIRCRAFT
W. S. Hindson (Natl. Res. Council of Can., Ottawa) and G. H. Hardy *In* AGARD Stability and Control May 1979 12 p refs (For primary document see N79-30218 21-08)
Avail: NTIS HC A16/MF A01

A program to assess the feasibility of piloted STOL approaches along predefined, steep, curved, and decelerating approach profiles was carried out with a powered-lift STOL aircraft. To reduce the pilot workload associated with the basic control requirements of a powered-lift aircraft equipped with redundant controls and operating on the backside of the power curve, separate stability augmentation systems for attitude and speed were provided, as well as a supporting flight director and special electronic cockpit displays. The control, display, and procedural features are described for the flight experiment that led to the conclusion that, given an adequate navigation environment, such constrained approaches may be feasible from a pilot acceptance point of view. G.Y.

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N79-30244*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PILOT CRYO TUNNEL: ATTACHMENTS, SEALS, AND INSULATION
John F. Wilson, George D. Ware, and James W. Ramsey, Jr. 1974 30 p ref Presented at ASCE Natl. Structural Meeting, Cincinnati, 22-26 Apr. 1974
(NASA-TM-80509) Avail: NTIS HC A03/MF A01 CSCL 14B

Several different tests are described which simulated the actual configuration of a cryogenic wind tunnel operating at pressures up to 5 atmospheres (507 kPa) and temperatures from -320 F (78K) to 120 F (322K) in order to determine compatible bolting, adequate sealing, and effective insulating materials. The evaluation of flange attachments (continuous threaded studs) considered bolting based on compatible flanges, attachment materials, and prescribed bolt elongations. Various types of seals and seal configurations were studied to determine suitability and reusability under the imposed pressure and temperature loadings. The temperature profile was established for several materials used for structural supports. A.R.H.

N79-30245# Royal Aircraft Establishment, Farnborough (England).
THE RESONANCE FREQUENCIES OF VENTILATED WIND TUNNELS
Dennis G. Mabey Apr. 1978 54 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal (RAE-TR-78038; Log-J11285) Avail: NTIS HC A04/MF A01

An improved theory was developed, which shows that the resonance frequencies of ventilated tunnels are influenced by the depth of the plenum chamber for Mach numbers up to about M = 0.6. Although the theory is approximate, it agreed well with experiments for slotted and perforated walls (with both normal and 60 deg inclined holes). The results are consistent with other experiments which show that plenum chamber design can influence the flow unsteadiness within the working section of a ventilated tunnel. Autho

N79-30246# New Mexico Univ., Albuquerque. Civil Engineering Research Facility.
AN EVALUATION OF ASPHALT-RUBBER MIXTURES FOR USE IN PAVEMENT SYSTEMS Final Report, Apr. 1977 - Feb. 1979
Dale S. Decker, Donald F. Griffin, and John P. Nielsen Tyndall AFB, Fla. Civil and Environ. Eng. Develop. Office Apr. 1979 83 p refs
(Contract F29601-76-C-0015; AF Proj. 2104)
(AD-A069448; CEEDO-TR-79-02) Avail: NTIS HC A05/MF A01 CSCL 13/3

The design and construction of airfield pavements have not been developed sufficiently to provide pavements that will not crack. Cracking is a response to traffic and environmental conditions or to the construction material. For many years, rubber in several different forms has been added to asphalt with limited success in reducing pavement cracking. This report reviews the efforts to control cracking by incorporating rubber and asphalt for application as membrane interlayers, surface seal coats, crack fillers, and joint sealers. The extensive literature review indicates that conflicting conclusions have been reached regarding varied applications of the asphalt-rubber material. Of the asphalt-rubber products available, those with high percentages of rubber (20 to 30 percent by weight) appear to be the most promising for airfield pavements, although the effectiveness of asphalt-rubber in controlling or reducing pavement cracking has not been conclusively demonstrated. No superiority of one asphalt-rubber product was indicated in the literature. Because of the danger of loose aggregate chips, the literature indicates that chip seal applications should not be used on facilities where loose chips could be a problem. Therefore, the membrane interlayer is the only application of asphalt-rubber that should be considered for military runways at this time. GRA

N79-30247# European Space Agency, Paris (France).
WALL CORRECTIONS IN TRANSONIC WIND TUNNEL: EQUIVALENT POROSITY
Xavier Vaucheret May 1979 135 p refs Transl. into ENGLISH of 'Corrections de Parois en Soufflerie Transsonique Porosite Equivalente', Rept. ONERA-P-1977-3 ONERA, Paris, 1977
(ESA-TT-545; ONERA-P-1977-3) Avail: NTIS HC A07/MF A01

A method for calculating wall effect corrections is presented for the present design of transonic wind tunnel test sections with perforated horizontal walls and for the dimensions of complete models or two dimensional profiles currently used in industrial testing. The calculations are performed using the concept of constant equivalent porosity on the walls, assuming symmetrical operation of the two walls in three dimensional flow and asymetrical operation in two dimensional flow. The experimental methods of determining the equivalent porosity are described. Finally, test section/model configurations are investigated in an attempt to minimize the wall effects. Author (ESA)

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N79-30248*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DEEP SPACE NETWORK Progress Report, May - Jun. 1979
15 Aug. 1979 119 p refs
(Contract NAS7-100)
(NASA-CR-157456; DSN-PR-42-52) Avail: NTIS HC A06/MF A01 CSCL 14B

Progress on the Deep Space Network (DSN) supporting research and technology, advanced development, engineering and implementation, and DSN operations is presented. The functions and facilities of the DSN are described. For individual titles, see N79-30249 through N79-30265.

N79-30249*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Office of Tracking and Data Acquisition.
NETWORK FUNCTIONS AND FACILITIES c14
N. A. Renzetti *In its* The Deep Space Network 15 Aug. 1979 p 1-3 (For primary document see N79-30248 21-12)
Avail: NTIS HC A06/MF A01 CSCL 14B

The objectives, and organization of the Deep Space Network are summarized. Deep space station, ground communication, and network operations control capabilities are described. Author

N79-30250*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Mission Support Office.
PIONEER 11 SATURN ENCOUNTER MISSION SUPPORT **c14**
R. B. Miller *In its* The Deep Space Network 15 Aug. 1979 p 4-7 ref (For primary document see N79-30248 21-12)
Avail: NTIS HC A06/MF A01 CSCL 14B

The Pioneer 11 Saturn encounter activities are described. The DSN plans for supporting the event are discussed. S.E.S.

N79-30251*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Radio Frequency and Microwave Subsystems Section.
GYROTRON: A HIGH-FREQUENCY MICROWAVE AMPLIFIER **c33**
A. Kupiszewski *In its* The Deep Space Network 15 Aug. 1979 p 8-12 refs (For primary document see N79-30248 21-12)
Avail: NTIS HC A06/MF A01 CSCL 09A

A proposed microwave amplifier mechanism for future generations of millimeter high power uplinks to spacecraft and planetary radar transmitters is introduced. Basic electron-electromagnetic field interaction theory for RF power gain is explained. The starting point for general analytical methods leading to detailed design results is presented. S.E.S.

N79-30252*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Tracking Systems and Applications Section.
CONNECTION AND VALIDATION OF NARROW-BAND DELTA VLBI PHASE OBSERVATIONS **c17**
S. C. Wu *In its* The Deep Space Network 15 Aug. 1979 p 13-20 refs (For primary document see N79-30248 21-12)
Avail: NTIS HC A06/MF A01 CSCL 17B

Narrow-band differential very long baseline interferometry required phase connections between consecutive scans. An efficient computer aided scheme for this purpose is presented. This scheme is an iteration process alternating between a grand fit on many scans and integer quantization of the phase shift cycles to be assigned to the scans. Only linear simultaneous equations of a few unknowns need to be solved. A simulation analysis indicates that faultless phase connection can be expected when there is no localized systematic noise. When systematic noise of moderate level exists, the possible incorrect phase connection can be detected and connected for by comparing the connected phases from the two alternating observations, after removing the residual diurnal effects. S.E.S.

N79-30253*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Communications Systems Research Section.
AN IMPROVED STORAGE BULB MOUNT FOR DSN HYDROGEN MASERS **c36**
P. R. Dachel, D. P. Russell, T. K. Tucker, and L. B. Stratman *In its* The Deep Space Network 15 Aug. 1979 p 21-25 refs (For primary document see N79-30248 21-12)
Avail: NTIS HC A06/MF A01 CSCL 20E

The presently used JPL hydrogen maser suspended atomic storage bulb and a rigid, single-plane mounted bulb are compared. The new bulb incorporates three major design changes: (1) mounting design; (2) alterations to the collimator; and (3) decrease in mass. These design changes are expected to increase the long-term stability of the frequency standard by reducing its sensitivity to vibration and thermal effects. S.E.S.

N79-30254*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Communications Systems Research Section.
A GENERALIZATION OF BINARY MINIMUM SHIFT KEYING AND STAGGERED QUADRIPHASE SHIFT KEYING MODULATION **c32**
J. L. Massey *In its* The Deep Space Network 15 Aug. 1979 p 26-40 refs (For primary document see N79-30248 21-12)
Avail: NTIS HC A06/MF A01 CSCL 17B

A generalized modulation scheme, which includes minimum shift keying (MSK) and staggered quadriphase shift keying (SQPSK) as special cases, is analyzed. The general modulator is realized as a one-input, two-output sequence transducer whose outputs select the carrier signal for each band. This form of the modulator has the practical advantage of not requiring any RF filtering since there is no actual mixing of the carriers with the modulating signals. It is shown that the optimum demodulator (whether hard-decision or soft-decision) always can make its decisions from the received waveform over two bands when the interference is additive white Gaussian noise, thus generalizing a well-known result for hard decision demodulation of MSK and SQPSK signals. The power spectra of MSK and SQPSK signals are derived to isolate the role played by coherency between the modulating signals and the carriers. Author

N79-30255*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Communications Systems Research Section.
INTERNAL NOISE OF A PHASE-LOCKED RECEIVER WITH A LOOP-CONTROLLED SYNTHESIZER **c33**
C. A. Greenhall *In its* The Deep Space Network 15 Aug. 1979 p 41-50 refs (For primary document see N79-30248 21-12)
Avail: NTIS HC A06/MF A01 CSCL 09A

A local oscillator design that uses a digitally programmed frequency synthesizer instead of an analog VCO was proposed. The integral of the synthesizer input, the digital phase, is a convenient measure of integrated Doppler. The internal noise of such a receiver was examined. At high carrier margin, the local oscillator phase noise equals that of the Block IV receiver, about 2 deg rms at S-band, whereas the digital phase noise is about 0.5 deg rms. S.E.S.

N79-30256*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Radio Frequency and Microwave Subsystems Section.
A PROTOTYPE DSN X-S BAND FEED: DSS 13 APPLICATION Status Report **c32**
W. Williams, D. Nixon, H. Reilly, J. Withington, and D. Bathker *In its* The Deep Space Network 15 Aug. 1979 p 51-60 refs (For primary document see N79-30248 21-12)
(SR-3) Avail: NTIS HC A06/MF A01 CSCL 20N

A prototype X-S band horn feed for future use at various DSN sites, dealing with the testing of the final fabricated feed at DSS 13 are discussed. Measured feedhorn patterns are presented, and efficiencies calculated. Preliminary results of system noise temperature and 26-m antenna system gain measurements are presented. Some measurements leading to an improved second generation feed are described. The results of the field measurements indicate that this horn will perform as originally specified and required. The tests for the second generation feed have indicated the potential cause of minor X-band moding. S.E.S.

N79-30257*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Communications Systems Research Section.
CODING FOR OPTICAL CHANNELS WITH PHOTON-COUNTING **c74**
R. J. McEliece and L. R. Welch *In its* The Deep Space Network 15 Aug. 1979 p 61-66 refs (For primary document see N79-30248 21-12)
Avail: NTIS HC A06/MF A01 CSCL 20F

The problem of coding for Pierce's recent model for optical communications is studied. It was concluded that for any positive rate rho (measured in nats per photon), the best code of length n has an error probability bounded by an exponentially decaying function of n. Explicit practical schemes are shown for rho less than or = to 1; and evidence is given that rho approximating 1 may be the practical limit for optical communication. M.M.M.

N79-30258*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Communication Systems Research Section.
A FAST TECHNIQUE FOR COMPUTING SYNDROMES OF BCH AND RS CODES **c63**
I. S. Reed (Univ. of Southern Calif.), T. K. Truong, and R. L. Miller *In its* The Deep Space Network 15 Aug. 1979 p 67-70 refs (For primary document see N79-30248 21-12)
Avail: NTIS HC A06/MF A01 CSCL 09B

A combination of the Chinese Remainder Theorem and Winograd's algorithm is used to compute transforms of odd length over GF(2 to the m power). Such transforms are used to compute the syndromes needed for decoding CBH and RS codes. The present scheme requires substantially fewer multiplications and additions than the conventional method of computing the syndromes directly. M.M.M.

N79-30259*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Radio Frequency and Microwave Subsystems Section.
NEW X-BAND ANTENNA FEEDS FOR THE DSN 64-METER STATIONS **c32**
R. Hartop *In its* The Deep Space Network 15 Aug. 1979 p 71-74 refs (For primary document see N79-30248 21-12)
Avail: NTIS HC A06/MF A01 CSCL 17B

New X-band antenna feed assemblies with dual-polarization capability are being implemented in the DSN 64-meter stations. Together with dual X-band traveling wave masers, they permit the simultaneous reception of right- and left-hand circular polarization from the Voyager spacecraft. The new feed also includes a dual hybrid mode feedhorn which increases the antenna gain by 0.36 dB over the present feedhorn. Author

N79-30260*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Radio Frequency and Microwave Subsystems Section.
MULTI-MISSION RECEIVER (MMR) **c17**
H. Donnelly and H. Nishimura *In its* The Deep Space Network 15 Aug. 1979 p 75-81 ref (For primary document see N79-30248 21-12)
Avail: NTIS HC A06/MF A01 CSCL 17B

An introduction to the Multi-Mission Receiver (MMR) is presented. The MMR contains occultation receiver channels (OCC) and very long baseline interferometry channels. The design considerations, performance and implementation of the OCC channels are discussed. M.M.M.

N79-30261*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Deep Space Station 62.
PRELIMINARY REPORT ON DSN SYSTEM PERFORMANCE UNDER LOCAL WEATHER EFFECTS **c32**
J. M. Urech *In its* The Deep Space Network 15 Aug. 1979 p 82-88 refs (For primary document see N79-30248 21-12)
Avail: NTIS HC A06/MF A01 CSCL 20N

Local effects of precipitation are studied, and a simplified working model is developed. Experimental results obtained by simulation are in good agreement with the model, showing that it could be an important contribution to system degradation. If this is confirmed, some suggestions for improvement are presented. M.M.M.

N79-30262*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. DSN Engineering Section.
COMPARISON OF TWO TOTAL ENERGY SYSTEMS FOR A DIESEL POWER GENERATION PLANT **c44**
V. W. Chai *In its* The Deep Space Network 15 Aug. 1979 p 89-93 ref (For primary document see N79-30248 21-12)
Avail: NTIS HC A06/MF A01 CSCL 10B

The capabilities and limitations, as well as the associated costs for two total energy systems for a diesel power generation plant are compared. Both systems utilize waste heat from engine cooling water and waste heat from exhaust gases. Pressurized water heat recovery system is simple in nature and requires no engine modifications, but operates at lower temperature ranges. On the other hand, a two-phase ebullient system operates the engine at constant temperature, provides higher temperature water or steam to the load, but is more expensive. M.M.M.

N79-30263*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. DSN Engineering Section.
MINIMIZING THE RMS SURFACE DISTORTIONS FROM GRAVITY LOADINGS OF THE 34-m HA-DEC ANTENNA FOR DEEP SPACE MISSIONS **c32**
S. M. Katow *In its* The Deep Space Network 15 Aug. 1979 p 94-98 refs (For primary document see N79-30248 21-12)
Avail: NTIS HC A06/MF A01 CSCL 20N

The computer analysis of the 34-m HA-DEC antenna by the IDEAS program provided the rms distortions of the surface panels support points for full gravity loadings in the three directions of the basic coordinate system of the computer model. The rms distortions for the gravity vector not in line with any of the three basic directions were solved and contour plotted starting from three surface panels setting declination angle. By inspections of the plots, it was concluded that the setting or rigging angle of -15 degrees declination minimized the rms distortions for sky coverage of plus or minus 22 declination angles to 10 degrees of ground mask. Author

N79-30264*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Telecommunications Systems Section.
INTERIM RADIO SPECTRUM SURVEILLANCE STATION **c32**
D. R. Hersey *In its* The Deep Space Network 15 Aug. 1979 p 99-107 refs (For primary document see N79-30248 21-12)
Avail: NTIS HC A06/MF A01 CSCL 17B

Radio frequency interference at NASA's deep space stations has become a serious problem. A radio spectrum surveillance capability at these stations is needed to determine the sources of interference so that preventative measures can be taken. The first phase of a program to develop this capability was the development of a low-cost surveillance station now in operation at the Goldstone Space Communication Complex near Barstow, California. This interim surveillance station is described and findings from the use of this equipment are presented. Author

N79-30265*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Radio Frequency and Microwave Subsystems Section.
X-BAND ATMOSPHERIC NOISE TEMPERATURE DATA AND STATISTICS AT GOLDSTONE, DSS 13, 1977 - 1978 **c46**
S. D. Slobin, K. B. Wallace, M. M. Franco, E. M. Andres, and O. V. Hester *In its* The Deep Space Network 15 Aug. 1979 p 108-116 refs (For primary document see N79-30248 21-12)
Avail: NTIS HC A06/MF A01 CSCL 04A

Sample data and cumulative distributions of atmospheric noise temperature increase above the quiescent baseline for the calendar years 1977 and 1978 are presented. Comparison is made with the existing Deep Space Network noise temperature statistics. M.M.M.

N79-30266*# Rockwell International Corp., Downey, Calif. Satellite Systems Div.
SPACE CONSTRUCTION SYSTEM ANALYSIS. PART 1: EXECUTIVE SUMMARY Final Report
Jun. 1979 295 p
(Contract NAS9-15718)
(NASA-CR-160295; SSD-79-0123) Avail: NTIS HC A13/MF A01 CSCL 22A

System analysis studies of space construction projects, primarily dealing with areas of space construction support services, construction facilities, orbit altitude, and orbit transfer are presented. R.E.S.

N79-30267*# Rockwell International Corp., Downey, Calif. Satellite Systems Div.
SPACE CONSTRUCTION SYSTEMS ANALYSIS STUDY. TASK 3: CONSTRUCTION SYSTEM SHUTTLE INTEGRATION Final Report
Jun. 1979 28 p
(Contract NAS9-15718)
(NASA-CR-160296) Avail: NTIS HC A03/MF A01 CSCL 22A

The implications and impacts devolving upon the orbiter by its utilization as a space construction facility for the selected flight system projects are presented. G.Y.

N79-30268*# Rockwell International Corp., Downey, Calif. Satellite Systems Div.
SPACE CONSTRUCTION DATA BASE
Jun. 1979 430 p refs
(Contract NAS9-15718)
(NASA-CR-160297; SSD-79-0125) Avail: NTIS HC A19/MF A01 CSCL 22A

Construction of large systems in space is a technology requiring the development of construction methods to deploy, assemble, and fabricate the elements comprising such systems. A construction method is comprised of all essential functions and operations and related support equipment necessary to accomplish a specific construction task in a particular way. The data base objective is to provide to the designers of large space systems a compendium of the various space construction methods which could have application to their projects. G.Y.

N79-30269*# Rockwell International Corp., Downey, Calif. Space Div.
SPACE CONSTRUCTION SYSTEM ANALYSIS. PART 1:

EXECUTIVE SUMMARY. SPECIAL EMPHASIS STUDIES Final Report
Jun. 1979 186 p ref
(Contract NAS9-15718)
(NASA-CR-160298; SSD-79-0126) Avail: NTIS HC A09/MF A01 CSCL 22A

Generic concepts were analyzed to determine: (1) the maximum size of a deployable solar array which might be packaged into a single orbit payload bay; (2) the optimal overall shape of a large erectable structure for large satellite projects; (3) the optimization of electronic communication with emphasis on the number of antennas and their diameters; and (4) the number of beams, traffic growth, and projections and frequencies were found feasible to package a deployable solar array which could generate over 250 kilowatts of electrical power. Also, it was found that the linear-shaped erectable structure is better for ease of construction and installation of systems, and compares favorably on several other counts. The study of electronic communication technology indicated that proliferation of individual satellites will crowd the spectrum by the early 1990's, so that there will be a strong tendency toward a small number of communications platforms over the continental U.S.A. with many antennas and multiple spot beams. A.R.H.

N79-30270*# Analytical and Computational Mathematics, Inc., Houston, Tex.
AN ANALYTICAL SATELLITE ORBIT PREDICTOR (ASOP)
Jul. 1979 198 p refs Revised
(Contract NAS9-15445)
(NASA-CR-160294; JSC-13094-Rev-1; Rept-77-FM-50-Rev-1)
Avail: NTIS HC A09/MF A01 CSCL 22A

The documentation and user's guide are presented for the analytical satellite orbit predictor computer program which is intended to be used for computation of near-earth orbits including those of the shuttle orbiter and its payloads. The Poincare-Similar elements used make it possible to compute near-earth orbits to within an accuracy of a few meters. Recursive equations are used instead of complicated formulas. Execution time is on the order of a few milliseconds. A.R.H.

N79-30879*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PLATFORMS IN SPACE: EVOLUTIONARY TRENDS
John M. Butler, Jr. *In its* Proc.: Workshop on the Need for Lightning Observations from Space Jul. 1979 p 159-182 (For primary document see N79-30869 21-46)
Avail: NTIS HC A12/MF A01 CSCL 22A

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N79-30271*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
AN ANALYTICAL SINGULARITY-FREE SOLUTION TO THE J2 PERTURBATION PROBLEM
Victor R. Bond Jul. 1979 29 p refs
(NASA-TM-58221; JSC-13128) Avail: NTIS HC A03/MF A01 CSCL 22A

The development of a singularity-free solution of the J2 problem in satellite theory is presented. The procedure resembles that of Lyndane who rederives Brouwer's satellite theory using Poincare elements. A comparable procedure is used in this report in which the satellite theory of Scheifele, who used elements similar to the Delaunay elements but in the extended phase space, is rederived using Poincare elements also in the extended phase space. Only the short-period effects due to J2 are included. Author

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N79-30249*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Office of Tracking and Data Acquisition.
NETWORK FUNCTIONS AND FACILITIES
N. A. Renzetti *In its* The Deep Space Network 15 Aug. 1979 p 1-3 (For primary document see N79-30248 21-12)
Avail: NTIS HC A06/MF A01 CSCL 14B

N79-30250*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Mission Support Office.
PIONEER 11 SATURN ENCOUNTER MISSION SUPPORT
R. B. Miller *In its* The Deep Space Network 15 Aug. 1979 p 4-7 ref (For primary document see N79-30248 21-12)
Avail: NTIS HC A06/MF A01 CSCL 14B

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N79-30272# European Space Operations Center, Darmstadt (West Germany). Operations Dept.
GEOS-2: EARLY ORBIT PHASE OPERATIONS, VOLUME 1
W. Wimmer and D. Heger Jan. 1979 93 p refs 2 Vol.
(GEOS-2-Vol-1) Avail: NTIS HC A05/MF A01

The official record of GEOS-2 early orbit operations, which began with lift-off at 10.43 GMT on July 14, 1978 and continued until routine phase was declared at 18.00 GMT on August 2, 1978 is presented. The conduct of the spacecraft and ground systems during launch phase, transfer orbit, and the near-synchronous orbit phase is reported in detail and the performance of on-board subsystems is briefly summarized. Once the spacecraft had been checked out and placed on geo-stationary position, the experiment switch-ON sequence was carried out, thus completing the early orbit phase of the mission. The GEOS-2 Early Orbit Phase Operation report is issued in two volume. All the descriptive points are presented. The graphs present S/C parameters as a function of time. Author (ESA)

N79-30273# European Space Operations Center, Darmstadt (West Germany). Operations Dept.
GEOS-2: EARLY ORBIT PHASE OPERATIONS, VOLUME 2
Jan. 1979 192 p 2 Vol.
(GEOS-2-Vol-2) Avail: NTIS HC A09/MF A01

The official record of GEOS-2 early orbit operations, which began with lift-off at 10.43 GMT on July 14, 1978 and continued until routine phase was declared at 18.00 GMT on August 2, 1978 is presented. The conduct of the spacecraft and ground systems during launch phase, transfer orbit, and the near-synchronous orbit phase is reported in detail and the performance of on-board subsystems is briefly summarized. Once the spacecraft had been checked out and placed on geo-stationary position, the experiment switch-ON sequence was carried out, thus completing the early orbit phase of the mission. The GEOS-2 graphs of all essential S/C parameters are presented as a function of time. Author (ESA)

N79-30274# European Space Agency, Paris (France). Science Dept.
THE ACHIEVEMENTS OF ESA SCIENTIFIC SATELLITES
Apr. 1979 95 p Original contains color illustrations
(SP-1013) Avail: NTIS HC A05/MF A01; ESA, Paris FF 75

The achievements of ESA scientific satellites in the period 1968 to 1978 are reviewed. In particular, the performances of ESRO-2, ESRO-1A and B, HEOS-1, HEOS-2, TD-1, ESRO-4, COS-B, GEOS-1 and 2, and of various sounding rockets are examined. Author (ESA)

N79-30276# Officine Galileo S.p.A., Florence (Italy).
DESIGN STUDY OF AN INFRARED EARTH SENSOR FOR ACCURATE EARTH POINTING OF A LOW ALTITUDE THREE AXIS STABILIZED SATELLITE Final Report
Paris ESA 14 Apr. 1978 249 p
(Contract ESTEC-2722/76/NL-AK(SC))
(Rept-390-DT-3) Avail: NTIS HC A11/MF A01

Adaptation of an already developed sensor for geostationary operation (OTS) to specified orbital conditions was studied. This function is to be performed by an optical adapter mounted in front of the sensor. The same infrared band 14 to 16.25 micrometers was used. Three solutions were examined: an inverting reflecting cone, a germanium refracting prism, and reflecting prisms. The refracting prism solution was selected and is described in detail. Experimental results show good agreement of the sensor performances with the specifications. Only the overall accuracy and the pitch/roll linear range are slightly outside the requested limits. Author (ESA)

N79-30276# Kayser Threde G.m.b.H., Munich (West Germany).
PHASE A: STUDY OF THE ADAPTATION OF SOUNDING ROCKET TECHNOLOGY FOR SPACELAB SUBSATELLITES
R. Klett and A. Schmalz Paris ESA Jun. 1978 140 p
(Contract ESA-3473/78-F-HGE(SC))
Avail: NTIS HC A07/MF A01

The feasibility of a low cost subsatellite to be released from Spacelab was studied. Goals and objectives include the design to cost of a series of ten subsatellites (excluding experiment development and experiment integration) for a target price, the definition and design of a basic subsatellite bus adaptable to various experiment requirements with add-on capability for more complex technical subsystems, and the maximum use of available sounding rocket hardware, technology, and procedures. The capabilities of the basic system proposed are an experiment mass of 15 to 25 kg, an experiment volume of 600 nm dia. by 250 nm in height, spin-stabilization from 10 rpm to 1 rps, an experiment power of 28V + or - 4V dc at low for 24hv, PCM telemetry (64 kbit/sec), and PCM telecommand (12 bit words). Author (ESA)

N79-30277# Messerschmidt-Boelkow G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Raumfahrt.
AERONOMIC SOUNDING ROCKET PROGRAM: COMPLEX PAYLOAD B2. REPORT OF SYSTEM DESIGN, INTEGRATION, TESTING AND FLIGHT Final Report
Hans Demharter, Guenter Hummeltenberg, Friedrich Kaczensky, and Hermann Waldmann Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1977 137 p In GERMAN; ENGLISH summary
Report will also be announced as translation (ESA-TT-589)
(Contract BMFT-WRT-274-2; DFVLR-BPT-01-DI-004)
(BMFT-FB-W-77-34) Avail: NTIS HC A07/MF A01; ZLDI, Munich DM 26,45

The technical design and development of three payloads for sounding rockets to be flown with SKYLARK 3 are described. Test results obtained during qualification and flight acceptance test with these payloads are shown and the performance of the payload systems is evaluated using the operations data recorded during flight by the ground station. Author (ESA)

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N79-30278*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
FLIGHT DESIGN SYSTEM-1 SYSTEM DESIGN. VOLUME 5: DATA MANAGEMENT AND DATA BASE DOCUMENTATION SUPPORT SYSTEM
Jun. 1979 175 p
(NASA-TM-80468; JSC-12564; Rept-77-FM-18-Vol-5-Rev-1)
Avail: NTIS HC A08/MF A01 CSCL 22A

Application software intended to reduce the man-hours required per flight design cycle by producing major flight design documents with little or no manual typing is described. The documentation support software is divided into two separately executable processors. However, since both processors support the same overall functions, and most of the software contained in one is also contained in the other, both are collectively presented. K.L.

N79-30279*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
RADAR ERROR STATISTICS FOR THE SPACE SHUTTLE
William M. Lear Jul. 1979 22 p refs
(NASA-TM-80508; JSC-16044; Rept-79-FM-24) Avail: NTIS HC A02/MF A01 CSCL 17I

Radar error statistics of C-band and S-band that are recommended for use with the groundtracking programs to process space shuttle tracking data are presented. The statistics are divided into two parts: bias error statistics, using the subscript B, and high frequency error statistics, using the subscript q. Bias errors may be slowly varying to constant. High frequency random errors (noise) are rapidly varying and may or may not be correlated from sample to sample. Bias errors were mainly due to hardware defects and to errors in correction for atmospheric refraction effects. High frequency noise was mainly due to hardware and due to atmospheric scintillation. Three types of atmospheric scintillation were identified: horizontal, vertical, and line of sight. This was the first time that horizontal and line of sight scintillations were identified. R.E.S.

N79-30280# Technische Universitaet, Munich (West Germany). Lehrstuhl fuer Raumfahrttechnik.
THE SPACE TUG: A CRITICAL ANALYSIS OF THE POSSIBLE PROPULSION SYSTEM [DER RAUMSCHLEPPER. EINE KRITISCHE BETRACHTUNG MOEGLICHER ANTRIEBSSYSTEME]
Harry O. Ruppe and Winfried M. Schauer Dec. 1976 639 p refs In GERMAN; ENGLISH summary
(TUM-RT-TB-26) Avail: NTIS HC A03/MF A01

The NASA decision in Autumn 1976 to develop the Tug as a two-stage, expendable vehicle with solid fuel engines marks the end of a long phase during which various proposals for such a system were studied. A review of the most important concepts that were considered is presented. The applicability of the different types of motor available, or likely to become available in the near future, is discussed and examples for each case are cited. The technological and economic limits of the various systems are described and the objectives for a future Tug generation developed. Author (ESA)

N79-30281# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
SPACELAB FOD: ANALYSIS OF THE MODULE AIRLOOP FOR ADDITIONAL HEAT REJECTION AND OPERATIONAL FLEXIBILITY Final Report
Paris ESA Sep. 1978 88 p
(Contract ESA-3556/78-F-HEW-(SC))
Avail: NTIS HC A05/MF A01

Avionics fan speed control, igloo active pressure control, additional nitrogen tanks, improved CO2 removal, air temperature reduction, and modular pack cooling, are considered in detail relative to the Spacelab follow-on development program. The main objectives are to continue participation of European know-how in manned space activities and to extend the areas of Spacelab utilization. Results provide a profound implementation basis in technical as well as programmatic terms. Author (ESA)

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N79-30252*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Tracking Systems and Applications Section.
CONNECTION AND VALIDATION OF NARROW-BAND DELTA VLBI PHASE OBSERVATIONS
S. C. Wu *In its* The Deep Space Network 15 Aug. 1979 p 13-20 refs (For primary document see N79-30248 21-12)
Avail: NTIS HC A06/MF A01 CSCL 17B

N79-30260*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Radio Frequency and Microwave Subsystems Section.
MULTI-MISSION RECEIVER (MMR)
H. Donnelly and H. Nishimura *In its* The Deep Space Network 15 Aug. 1979 p 75-81 ref (For primary document see N79-30248 21-12)
Avail: NTIS HC A06/MF A01 CSCL 17B

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N79-30282# Eidgenoessisches Flugzeugwerk, Emmen (Switzerland). Research and Testing Dept.
EXPLOITATION DEVELOPMENT OF A VAPOR COMPRESSOR FOR SPACE FLIGHT APPLICATIONS **Final Report**
F. Berner, H. Oesch, and H. Steinhauser Paris ESA Dec. 1978 81 p refs
(Contract ESTEC-3446/77/NL-PP(SC))
(F&W-FO-1441; ESA-CR(P)-1161) Avail: NTIS HC A05/MF A01

A single-cylinder compressor for use in a heat pump was designed, built, and subjected to a series of functional tests. A number of innovations were built into the compressor, such as a spring which reduces the nonuniformity of rotation, and a semi-automatic discharge valve which opens when the pressure in the cylinder exceeds the discharge pressure and which is closed by a camshaft/rocker arm assembly. Other features include dry lubrication of the piston ring and axial guidance of the piston by means of an axial ball box as well as bellows which seal off the refrigerant against the outside and against all lubricated parts within the compressor. Certain difficulties were encountered outing the functional tests, mainly with the camshaft/rocher arm/discharge valve assembly. The causes for these difficulties were identified and design changes to overcome them are proposed. Author (ESA)

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N79-30283*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HANDBOOK OF RECOMMENDED PRACTICES FOR THE DETERMINATION OF LIQUID MONOPROPELLANT ROCKET ENGINE PERFORMANCE
R. A. Bjorklund, R. S. Rogero, and R. K. Baerwald 1 Jun. 1979 282 p refs
(Contracts NAS7-100; F04611-76-X-0053)
(NASA-CR-162111; JPL-Pub-79-32) Avail: NTIS HC A13/MF A01 CSCL 21H

The design, installation, and operation of systems to be used for directly measuring quantities of fundamental importance to the determination of monopropellant thruster performance is described. Areas covered include: (1) force and impulse measurement; (2) propellant mass usage and flow measurement; (3) pressure measurement; (4) temperature measurement; (5) exhaust gas composition measurement; and (6) data reduction and performance determination. For individual titles, see N79-30284 through N79-30289.

N79-30284*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FORCE AND IMPULSE MEASUREMENT
In its Handbook of Recommended Practices for the Determination of Liquid Monopropellant Rocket Engine Performance 1 Jun. 1979 28 p refs (For primary document see N79-30283 21-20)
Avail: NTIS HC A13/MF A01 CSCL 21H

Practices are outlined for the design, installation, checkout, calibration, and operation of a thrust measurement system to be used during tests of a liquid monopropellant rocket engine. Appendixes include: (1) thrust measurement system elemental uncertainties; (2) short- and long-term thrust measurement system uncertainty; and (3) shunt calibration of force transducers. K.L.

N79-30285*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PROPELLANT MASS USAGE AND FLOW MEASUREMENT
In its Handbook of Recommended Practices for the Determination of Liquid Monopropellant Rocket Engine Performance 1 Jun. 1979 32 p refs (For primary document see N79-30283 21-20)
Avail: NTIS HC A13/MF A01 CSCL 21H

Practices are outlined for the design, installation, checkout, calibration, and operation of a system to be used for measuring propellant flow in a liquid monopropellant rocket engine. Design guidelines rather than detailed specifications are provided for the critical components of each portion of the system. System elemental uncertainties are presented in an appendix. K.L.

N79-30286*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PRESSURE MEASUREMENT
In its Handbook of Recommended Practices for the Determination of Liquid Monopropellant Rocket Engine Performance 1 Jun. 1979 76 p refs (For primary document see N79-30283 21-20)
Avail: NTIS HC A13/MF A01 CSCL 21H

Practices are outlined for the design, installation, checkout, calibration, and operation of a pressure measuring system to be used during tests of a liquid monopropellant rocket engine. Appendixes include: (1) pressure measurement system elemental uncertainties; (2) short- and long-term pressure measurement system uncertainty; (3) shunt calibration of pressure transducers; (4) special considerations for vacuum measurement; and (5) methods of determining the dynamic characteristics of pressure transducers. Design guidelines are provided for the critical components of each portion of the system to provide a pressure measurement system which meets the performance criteria specified. K.L.

N79-30287*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TEMPERATURE MEASUREMENT
In its Handbook of Recommended Practices for the Determination of Liquid Monopropellant Rocket Engine Performance 1 Jun.

1979 36 p refs (For primary document see N79-30283 21-20)
Avail: NTIS HC A13/MF A01 CSCL 21H

The design, installation, checkout, calibration, and operation of a temperature measuring system to be used during tests of a liquid monopropellant rocket engine are discussed. Appendixes include: (1) temperature measurement system elemental uncertainties, and (2) tables and equations for use with thermocouples and resistance thermometers. Design guidelines are given for the critical components of each portion of the system to provide an optimum temperature measurement system which meets the performance criteria specified. K.L.

N79-30288*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EXHAUST GAS COMPOSITION MEASUREMENT
In its Handbook of Recommended Practices for the Determination of Liquid Monopropellant Rocket Engine Performance 1 Jun. 1979 13 p refs (For primary document see N79-30283 21-20)
Avail: NTIS HC A13/MF A01 CSCL 21H

The design, installation, checkout, and operation of an exhaust gas composition measurement system for collecting and analyzing the exhaust gas from a liquid monopropellant rocket engine are described. Design guidelines are given for the critical components of each portion of the system to provide an exhaust gas composition measurement which meets the performance criteria specified. K.L.

N79-30289*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DATA REDUCTION AND PERFORMANCE DETERMINATION
In its Handbook of Recommended Practices for the Determination of Liquid Monopropellant Rocket Engine Performance 1 Jun. 1979 45 p refs (For primary document see N79-30283 21-20)
Avail: NTIS HC A13/MF A01 CSCL 21H

Definitions, algorithms, and procedures for the reduction of monopropellant thruster measurements to performance parameters are provided. A brief discussion of acquisition and recording systems is also included. Emphasis is placed upon monopropellant hydrazine engines, and some parameters relate specifically to the catalytic decomposition of hydrazine (e.g., percent ammonia dissociation). Performance of other types of monopropellant thrusters may, however, be determined by using procedures similar to those discussed. Two appendixes are included: (1) theoretical performance of monopropellant hydrazine; and (2) calculation of rotational performance. K.L.

N79-30290*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CHARACTERISTICS OF PRIMARY ELECTRIC PROPULSION SYSTEMS
David C. Byers 1979 17 p refs Proposed for Presentation at 14th Intern. Conf. on Elec. Propulsion, Princeton, N. J., 31 Oct. - 2 Nov. 1979; sponsored by AIAA and GLR
(NASA-TM-79255; E-166) Avail: NTIS HC A02/MF A01 CSCL 21C

The use of advanced electric propulsion systems is expected to provide cost and performance benefits for future energetic space missions. A methodology to predict the characteristics of advanced electric propulsion systems was developed and programmed for computer calculations to allow evaluation of a broad set of technology and mission assumptions. The impact on overall thrust system characteristics was assessed for variations of propellant type, total accelerating voltage, thruster area, specific impulse, and power system approach. The data may be used both to provide direction to technology emphasis and allow for preliminary estimates of electric propulsion system properties for a wide variety of applications. Author

N79-30291# European Space Agency, Paris (France).
ENERGY LOSSES IN HIGH ENERGY ROCKET ENGINES WITH THRUST VARIATION
Hans J. Sternfeld Mar. 1979 161 p refs Transl. into ENGLISH of 'Energieverluste in Hochenergetischen Raketentriebwerken bei Schubvariation', Rept. DLR-FB-77-41 DFVLR, Lampoldshausen, West Germany, 15 Sep. 1977 Original report in GERMAN previously announced as ESA-91023 Original German report available from DFVLR, Cologne DM 43,50
(ESA-TT-515; DLR-FB-77-41) Avail: NTIS HC A08/MF A01

The effect of various parameters on the energy losses in the combustion chamber of oxygen/hydrogen, fluorine/hydrogen, and fluorine/ammonia rocket engines was investigated. A thrust variation of capacitatively cooled experimental rocket engines between 200 and 1,500 N was provided by a combustion chamber pressure variation between 3 and 15 bars. The energy losses of a fluorine/ammonia rocket engine were compared with results obtained with the distributed Energy Release-computer model. Results of the investigation are presented an two dimensional approximation functions. The energy losses of rocket engines with coaxial injectors can be described by the parameters MIXEFF and VAPTIME, which characterize the imperfect mixing and the incomplete vaporization of the propellants. Author (ESA)

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N79-30292# National Bureau of Standards, Washington, D. C. Center for Absolute Physical Quantities.
STANDARD REFERENCE MATERIALS: SRM 768: TEMPERATURE REFERENCE STANDARD FOR USE BELOW 0.5 K
R. J. Stolen, Jr. and R. B. Dove Apr. 1979 52 p refs
(PB-294245/6; NBS-SP-260-62; LC-79-600014) Avail: NTIS HC A04/MF A01 CSCL 14B

The SRM 768 consists of a self-contained assembly of coils and five samples which can be used to provide in situ temperature calibration. Simple room temperature electronics readily permit the observation of the five narrow and highly reproducible superconducting phase transitions. These phase transitions were signed temperature values by means of fundamental thermometers used at the National Bureau of Standards. Provided that care is exercised in reducing the magnetic field acting upon the device, the user can confidently expect to achieve a temperature reproductibility and traceability to the NBS temperature scale of plus or minus 0.3 mK. GRA

24 COMPOSITE MATERIALS

Includes laminates.

N79-30293 Royal Aircraft Establishment, Farnborough (England).
RAIN-EROSION RESISTANT MATERIALS IN AIR AND SPACE TRAVEL
Dec. 1978 17 p refs Transl. into ENGLISH of "Regenerosionsbestandige Werkstoffe in der Luft-und Raumfahrt", Rept. MBB-WF-Information-5/78 Messerschmitt-Boelkow-Blohm G.m.b.H., Munich p 2-10
(BLL-RAE-Lib-Trans-2003-(5207); RAE-Lib-Trans-2003; BR67275) Avail: British Library Lending Div., Boston Spa, Engl.

The development of rain erosion resistant protective coatings for radomes is described for use in subsonic applications on aircraft and for supersonic applications on missiles at velocities up to Mach 6. The associated requirements for antistatic, antiflash and ablation on the reentry of missiles are also considered. Tests are described, mostly in the USA, and examples given of suitable materials for each application. Some flight experience with erosion damage sustained on Starfighters of the Federal German Air Force is included. Author

N79-30294*# Lehigh Univ., Bethlehem, Pa. Inst. of Fracture and Solid Mechanics.
OFF-AXIS IMPACT OF UNIDIRECTIONAL COMPOSITES WITH CRACKS: DYNAMIC STRESS INTENSIFICATION Interim Report
G. C. Sih and E. P. Chen Jan. 1979 65 p refs
(Grant NsG-3179)
(NASA-CR-159537; IFSM-79-95) Avail: NTIS HC A04/MF A01 CSCL 11D

The dynamic response of unidirectional composites under off axis (angle loading) impact is analyzed by assuming that the composite contains an initial flaw in the matrix material. The

analytical method utilizes Fourier transform for the space variable and Laplace transform for the time variable. The off axis impact is separated into two parts, one being symmetric and the other skew-symmetric with reference to the crack plane. Transient boundary conditions of normal and shear tractions are applied to a crack embedded in the matrix of the unidirectional composite. The two boundary conditions are solved independently and the results superimposed. Mathematically, these conditions reduce the problem to a system of dual integral equations which are solved in the Laplace transform plane for the transformation of the dynamic stress intensity factor. The time inversion is carried out numerically for various combinations of the material properties of the composite and the results are displayed graphically.

Author

N79-30295*# General Electric Co., Cincinnati, Ohio.
METAL SPAR/SUPERHYBRID SHELL COMPOSITE FAN BLADES Final Report
C. T. Salemme and G. C. Murphy Aug. 1979 135 p
(Contract NAS3-20402)
(NASA-CR-159594) Avail: NTIS HC A07/MF A01 CSCL 11D

The use of superhybrid materials in the manufacture and testing of large fan blades is analyzed. The FOD resistance of large metal spar/superhybrid fan blades is investigated. The technical effort reported was comprised of: (1) preliminary blade design; (2) detailed analysis of two selected superhybrid blade designs; (3) manufacture of two process evaluation blades and destructive evaluation; and (4) manufacture and whirligig testing of six prototype superhybrid blades. A.W.H.

N79-30296*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FATIGUE BEHAVIOR OF SiC REINFORCED TITANIUM COMPOSITES
R. T. Bhatt and H. H. Grimes 1979 19 p refs Presented at Symp. on Fatigue of Fibrous Composite Mater., San Francisco, 22-23 May 1979; sponsored by Am. Soc. for Testing and Mater.
(NASA-TM-79223; E-118) Avail: NTIS HC A02/MF A01 CSCL 11D

The low cycle axial fatigue properties of 25 and 44 fiber volume percent SiC/Ti(6Al-4V) composites were measured at room temperature and at 650 deg C. The S-N curves for the composites showed no anticipated improvement over bulk matrix behavior at room temperature. Although axial and transverse tensile strength results suggest a degradation in SiC fiber strength during composite fabrication, it appears that the poor fatigue life of the composites was caused by a reduced fatigue resistance of the reinforced Ti(6Al-4V) matrix. The reduced matrix behavior was due, to the presence of flawed and fractured fibers created near the specimen surfaces by preparation techniques and to the large residual tensile stresses that can exist in fiber reinforced matrices. The effects of fatigue testing at high temperature are discussed. A.W.H.

N79-30297*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
GRAPHITE/POLYIMIDE COMPOSITES
H. Benson Dexter, ed. and John G. Davis, Jr., ed. Aug. 1979 449 p refs Proc. held at Hampton, Va., 28 Feb. - 1 Mar. 1979
(NASA-CP-2079; L-12953) Avail: NTIS HC A19/MF A01 CSCL 11D

Technology developed under the Composites for Advanced Space Transportation System Project is reported. Specific topics covered include fabrication, adhesives, test methods, structural integrity, design and analysis, advanced technology developments, high temperature polymer research, and the state of the art of graphite/polyimide composites. For individual titles, see N79-30298 through N79-30329.

N79-30298*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
COMPOSITES FOR ADVANCED SPACE TRANSPORTATION SYSTEMS - (CASTS)
John G. Davis, Jr. *In its* Graphite/Polyimide Composites Aug. 1979 p 5-18 refs (For primary document see N79-30297 21-24)
Avail: NTIS HC A19/MF A01 CSCL 11D

The CASTS Project initiated to develop graphite fiber/polyimide matrix (GR/PI) composite structures with 589K operational capability for aerospace vehicles is described. Near term tasks include screening composites and adhesives for 589K service, developing fabrication procedures and specifications, developing design allowables test methods and data, design and test of structural elements, and construction of a full scale aft body flap for the space shuttle orbiter vehicle for ground testing. Far term tasks include research efforts directed at new materials, manufacturing procedures and design/analysis methodology. Specific results discussed include: (1) identification of four GR/PI composites and three PI adhesives with 589K service potential for periods ranging from 125 to 500 hours; (2) development of an adhesive formulation suitable for bonding reusable surface insulation (RSI) titles to 589K (GR/PI) substructure; (3) the capability to fabricate and nondestructively inspect laminates, hat section shaped stiffeners, honeycomb sandwich panels, and chopped fiber moldings; and (4) test methods for measuring design allowables at 117K. J.M.S.

N79-30299*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
LaRC FABRICATION DEVELOPMENT
Robert M. Baucom *In its* Graphite/Polyimide Composites Aug. 1979 p 19-37 (For primary document see N79-30297 21-24)
Avail: NTIS HC A19/MF A01 CSCL 11D

The results of in-house efforts in support of the Supersonic Cruise Research (SCR) Program to develop fabrication procedures for the manufacture of GR/PI wing panels for the NASA YF-12 airplane are reported. In addition, manufacturing procedures are outlined for the fabrication of structures in support of the CASTS Project. The results of studies directed toward the development of GR/PI prepreg manufacturing capability, assembly of structural elements from prepreg, final processing of GR/PI structural shapes, and techniques for verification of structural integrity are presented. J.M.S.

N79-30300*# General Dynamics/Convair, San Diego, Calif.
DEVELOPMENT OF FABRICATION TECHNIQUES FOR NR150B2-S5X GRAPHITE/POLYIMIDE HIGH TEMPERATURE COMPOSITES
W. G. Scheck, C. W. Smith, and E. Harrison *In* NASA. Langley Res. Center Graphite/Polyimide Composites Aug. 1979 p 39-60 (For primary document see N79-30297 21-24)
(Contract NAS1-14784)
Avail: NTIS HC A19/MF A01 CSCL 11D

Fabrication techniques for NR-150B2-S5X graphite/polyimide composites are described. The development of fabrication, tooling, and quality assurance techniques used for the composites is discussed. Processing information and preliminary mechanical property data are presented along with long term aging data.

J.M.S.

N79-30301*# Boeing Aerospace Co., Seattle, Wash.
DEVELOPMENT AND DEMONSTRATION OF MANUFACTURING PROCESSES FOR FABRICATING GRAPHITE/PMR-15 POLYIMIDE STRUCTURAL ELEMENTS
C. H. Sheppard, J. T. Hoggatt, and W. A. Symonds *In* NASA. Langley Res. Center Graphite/Polyimide Composites Aug. 1979 p 61-84 (For primary document see N79-30297 21-24)
(Contract NAS1-15009)
Avail: NTIS HC A19/MF A01 CSCL 11D

The processing requirements for graphite/PMR-15 polyimide composites developed to demonstrate the structural integrity of polyimide composite structural elements at temperatures up to 589K (600 F) are described. Major tasks included: quality assurance development; materials and process development; specification verification; flat panel fabrication; stiffened panel fabrication; honeycomb panel fabrication; chopped fiber moldings; and demonstration component fabrication. Materials, processing, and quality assurance documents were prepared from experimentally derived data. Structural elements consisting of flat panels, corrugated stiffeners, I-beams, hat stiffeners, honeycomb panels, and chopped fiber moldings were made and tested. Property data from 219K (-65 F) to 589K (600 F) were obtained. All

elements were made in a production environment. The size of each element was sufficient to insure production capability and structural component applicability. Problems associated with adhesive bonding, laminate and structural element analysis, material variability, and test methods were addressed. J.M.S.

N79-30302*# Rockwell International Corp., Downey, Calif. Space Systems Group.
LaRC-160 FABRICATION DEVELOPMENT
J. Devereaux Leahy *In* NASA. Langley Res. Center Graphite/Polyimide Composites Aug. 1979 p 85-106 (For primary document see N79-30297 21-24)
Avail: NTIS HC A19/MF A01 CSCL 11D

The scope and status of the fabrication development program on the third candidate graphite/polyimide material, utilizing the LARC-160 polyimide system is reported. The results of initial chemical characterization studies on resin monomer constituents and intermediate esters are discussed, in particular, the problem of identifying the nadic ester endcapper material and establishing specifications to ensure material reproducibility. Progress on the process development task, including prestaging, cure, and postcure studies on flat laminates is reported. In addition, the design and processing of hat and 'I' section stiffeners is reviewed. Initial efforts on the development of standards for nondestructive C-scan inspection for the various types of structures are discussed. The approach to qualifying the developed processes is outlined along with other ancillary studies in progress. J.M.S.

N79-30303*# Hercules, Inc., Magna, Utah. Bacchus Works.
INTERIM RESULTS OF THERMID 600 ENGINEERING DEVELOPMENT
Richard D. Hoffman *In* NASA. Langley Res. Center Graphite/Polyimide Composites Aug. 1979 p 107-110 (For primary document see N79-30297 21-24)
(Contract F33615-78-C-5167)
Avail: NTIS HC A19/MF A01 CSCL 11D

Thermid 600 was developed and evaluated as a matrix material for advanced composite structure applications in harsh environments. Prepreg work needed to develop a versatile and reproducible prepreg and fabrication work needed to develop laminate and structural shape processing methods are described. The use of reactive diluents in resin mixture studies with heat resin screening, prepreg process scaleup, and selection of final candidate are discussed. J.M.S.

N79-30304*# Rockwell International Corp., Downey, Calif.
FABRICATION OF STRUCTURAL ELEMENTS
Fred J. Darms, Jr. *In* NASA. Langley Res. Center Graphite/Polyimide Composites Aug. 1979 p 111-122 (For primary document see N79-30297 21-24)
(Contract NAS1-15183)
Avail: NTIS HC A19/MF A01 CSCL 11D

The laminate fabrication procedures and quality assurance ultrasonic C-scan results used for structural elements are described. These procedures are the result of processing eleven lots of graphite/PMR-15 prepreg tape materials and two lots of graphite/NR-150B2. Early processing difficulties with NR-150B2 composites were corrected, permitting the fabrication of quality specimens from either of the two currently prescribed matrix materials. The quality of all deliverable specimens is measured by the control of fiber content, glass transition temperature, and void content, as well as laminate ultrasonic C-scan data. J.M.S.

N79-30305*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
POLYIMIDE ADHESIVE BONDING
Donald Progar *In its* Graphite/Polyimide Composites Aug. 1979 p 123-138 refs (For primary document see N79-30297 21-24)
Avail: NTIS HC A19/MF A01 CSCL 11D

Adhesive systems which could be used to bond composite-to-composite, composite-to-titanium, and honeycomb sandwich structures with operational capability at 589K for a minimum of 125 hours were evaluated. Evaluations were based on mechanical property tests such as lap shear and flatwise tensile and on processability. Quasi-isotropic Celion 6000/PMR-15 composite adherend was used to construct lap shear and flatwise tensile specimens. Hexcel's HRH-327-3/16-6.0 glass polyimide honeycomb core was also utilized in the flatwise tensile specimens. Numerous processing variations were also studied that led to selected cure cycles for each adhesive. Shear specimens having either 12 mm or 75 mm overlaps were used to determine the effect of bond size on processability and lap shear properties. The data indicate that processing of FM-34, FM-34B-18, LARC-13 and NR056X can be achieved using a cure compatible with the composite adherend. No significant differences in mechanical properties were observed among the three adhesive systems and all three are suitable candidates for 589K/125 hour service. J.M.S.

N79-30306*# Rockwell International Corp., Downey, Calif.
ADHESIVES FOR BONDING RSI TILE TO Gr/Pi STRUCTURE FOR ADVANCED SPACE TRANSPORTATION SYSTEMS
Kenneth E. Smith, Charles L. Hamermesh, and Peter A. Hogenson *In* NASA. Langley Res. Center Graphite/Polyimide Composites Aug. 1979 p 139-148 (For primary document see N79-30297 21-24)
Avail: NTIS HC A19/MF A01 CSCL 11D

An adhesive was developed having improved high-temperature capability while retaining the ideal processing characteristics of RTV silicones. After evaluating several possibilities, mixtures of RTV with glass resins were selected as most promising. While results are not conclusive, tests of the final mixture evaluated, designated RA59, indicated capability of performing as a tile bonding agent to temperatures approaching 370C (700F) during repeated cycling. M.M.M.

N79-30307*# Du Pont de Nemours (E. I.) and Co., Aiken, S. C.
NR-150 ADHESIVE DEVELOPMENT
Philip S. Blatz and Hugh H. Gibbs *In* NASA. Langley Res. Center Graphite/Polyimide Composites Aug. 1979 p 149-162 (For primary document see N79-30297 21-24)
Avail: NTIS HC A19/MF A01 CSCL 11D

A polyimide precursor adhesive solution, code-named NR-056X, was developed. It reproducibly gives low void, high strength bond lines at both room temperature and 589K (600 F) using either titanium or graphite/polyimide composite adherends having 12.7 mm (1/2 in.) overlaps. Lap shear samples prepared using this adhesive and composite adherends based on graphite/NR-150B2 were shown to have a high degree of resistance to such adverse environments as air at 589K (600 F), high humidity, methyl ethyl ketone and jet fuel. Bond line toughness was illustrated by the complete resistance to cracking in the wedge-crack propagation test. The available evidence indicates that wide area composite to composite or composite to metal bonding should be feasible. M.M.M.

N79-30308*# Boeing Aerospace Co., Seattle, Wash.
DEVELOPMENT OF LARC-13 ADHESIVE SYSTEMS
John T. Hoggatt *In* NASA. Langley Res. Center Graphite/Polyimide Composites Aug. 1979 p 163-174 (For primary document see N79-30297 21-24)
Avail: NTIS HC A19/MF A01 CSCL 11D

Various adhesive formulations were evaluated and the effects of various environments upon different titanium bond surface treatments were noted. Initial data show LARC-13 to possess good 589K (600 F) stability as compared to other high temperature stable systems. M.M.M.

N79-30309*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
GRAPHITE/POLYIMIDE TENSION TESTS AT ELEVATED AND CRYOGENIC TEMPERATURES
Andrew J. Chapman *In its* Graphite/Polyimide Composites Aug. 1979 p 175-188 (For primary document see N79-30297 21-24)
Avail: NTIS HC A19/MF A01 CSCL 11D

Interim results for characterizing tension properties of graphite/polyimide laminates are reported. Existing test procedures for resin-matrix composites were evaluated for use through the extreme temperature range indicated above. Of particular concern was the performance of resistance strain gages at the elevated temperatures and tests were carried out to compare their performance against that of a capacitive strain gage. Limited design data are reported for graphite/polyimide laminates which are being produced through the CASTS Project. M.M.M.

N79-30310*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SANDWICH BEAM COMPRESSIVE TEST METHOD
Mark J. Shuart *In its* Graphite/Polyimide Composites Aug. 1979 p 189-200 refs (For primary document see N79-30297 21-24)
Avail: NTIS HC A19/MF A01 CSCL 11D

Tests presented show that the sandwich beam in four-point bending could be used to obtain reliable compressive elastic constants for graphite/polyimide laminates although some difficulties were encountered measuring composite compressive strengths. Data were obtained for ultimate stress, ultimate strain, Young's modulus, and Poisson's ratio values in 117K, room temperature, and 589K test environments for the HTS1/PMR-15 material system. A total of 36 compressive tests on various laminates were performed. Also, 24 tensile tests on the same laminate orientations were performed to obtain input to the analytical portion of this program. A portion of the beam test section was analyzed using a linear elastic finite element computer program to predict the stress state in the graphite/polyimide composite. The influence of the honeycomb core of this stress state was analytically determined. M.M.M.

N79-30311*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
APPLICATIONS OF THE IITRI COMPRESSION TEST FIXTURE AT ELEVATED TEMPERATURE
Charles J. Camarda *In its* Graphite/Polyimide Composites Aug. 1979 p 201-220 refs (For primary document see N79-30297 21-24)
Avail: NTIS HC A19/MF A01 CSCL 11D

The purpose of the present paper is to describe an application of the IITRI compression test fixture at elevated temperature (589K) was described as well as the present compressive moduli and ultimate strains of HTS/PMR-15 graphite/polyimide material. Considerable care was taken in specimen fabrication to minimize back-to-back strain variations due to specimen bending. The effects of specimen width and temperature were studied for various laminate orientations. The IITRI specimen was analyzed using three dimensional finite elements to determine the magnitude and location of stress concentrations to assess their potential effects on measured moduli and ultimate strains. Stress concentrations are of concern since end constraints, free-edge effects, and thermal effects add to the three dimensional nature of stresses in a specimen. M.M.M.

N79-30312*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
RAIL SHEAR TEST METHOD
Ramon Garcia and Robert R. McWithey *In its* Graphite/Polyimide Composites Aug. 1979 p 221-238 refs (For primary document see N79-30297 21-24)
Avail: NTIS HC A19/MF A01 CSCL 11D

The results of both an experimental test program and a finite element analysis of selected graphite/polyimide rail shear test specimens are discussed. The two dimensional finite element analysis includes both mechanical and thermal loading (differential expansion) of the specimens and their elastic rails. Parameters in this analysis of unidirectional and symmetric, balanced angle-ply laminates include ply layup angles, the effect of flexible rails, the method of load introduction to the specimen and the effect of uniform heating of the specimen and rails. Two types of tensile rail shear fixtures were investigated experimentally: a uniform thickness, bolted-rail shear fixture loaded diagonally across the specimen test section; and a tapered thickness, bonded-rail shear fixture loaded axially along the center-line of the specimen test section. Test results include room-temperature and 589K strain data taken from the center of the specimen test section during loading. Author

N79-30313*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EFFECTS OF LOW-VELOCITY IMPACT ON Gr/Pi COMPRESSION LAMINATES
Ramon Garcia and Marvin D. Rhodes *In its* Graphite/Polyimide Composites Aug. 1979 p 239-248 refs (For primary document see N79-30297 21-24)
Avail: NTIS HC A19/MF A01 CSCL 11D

The results of low velocity impact tests conducted on a graphite-polyimide laminate are presented. The 48-ply orthotropic laminate tested during this investigation is typical of laminates being proposed for heavily loaded aircraft wing skins. The nature of the damage is described as well as the effect of that damage on the compression strength of the 48-ply orthotropic laminate. The results obtained for the graphite-polyimide laminate are compared to existing results of similar tests conducted on other graphite-epoxy laminates. M.M.M.

N79-30314*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PRELIMINARY BOLTED-JOINT DATA
Gregory R. Wichorek *In its* Graphite/Polyimide Composites Aug. 1979 p 249-258 (For primary document see N79-30297 21-24)
Avail: NTIS HC A19/MF A01 CSCL 11D

Bolted-joint strength and failure modes for advanced graphite/polyimide composite laminates at 116K (-250 F), room temperature, and 589K (600 F) were determined to provide preliminary design data. The bolted-joint test setup for the low and elevated temperature tests is described. Test results are reported on a quasi-isotropic laminate of Celion 6000/PMR-15. Single bolt, double lap shear specimens were tested to obtain maximum joint strength and failure mode. The effect of joint geometry and temperature on joint strength and failure mode is presented. S.E.S.

N79-30315*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FATIGUE AND FRACTURE
Walter Illg and Richard A. Everett, Jr. (Army Res. and Technol. Labs.) *In its* Graphite/Polyimide Composites Aug. 1979 p 259-272 (For primary document see N79-30297 21-24)
Avail: NTIS HC A19/MF A01 CSCL 11D

The effects of the load/temperature environment of the shuttle on the fatigue life of the body-flap were investigated by conducting real time and accelerated flight-by-flight tests up to 500 flights on coupons containing holes. On the fracture side, much is known about the sensitivity of the tensile strengths of composites to holes and other flaws, predominantly at room temperature. The effects of notches were assessed for graphite/polyimides at the expected temperature extremes of the body-flap: 117K (-250 F) to 589K (600 F). Results indicate that the shuttle temperature extremes may affect fatigue properties HTS/PMR-15. There is no significant effect of temperature on notch-strength. Tensile strengths for specimens with holes and slots are equal. S.E.S.

N79-30316*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
MECHANICAL PROPERTY DEGRADATION OF GRAPHITE/POLYIMIDE COMPOSITES AFTER EXPOSURE TO MOISTURE OR SHUTTLE ORBITER FLUIDS
W. Barry Lisagor *In its* Graphite/Polyimide Composites Aug. 1979 p 273-288 (For primary document see N79-30297 21-24)
Avail: NTIS HC A19/MF A01 CSCL 11D

The effects of moisture exposure on the mechanical properties of graphite polyimide systems are presented. The mechanism of the degradation and the magnitude of the affect associated with specific mechanical properties is investigated. An experimental effort involving exposure to selected environmental variables and subsequent mechanical property testing and analysis is included. S.E.S.

N79-30317*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
MECHANICAL AND THERMOPHYSICAL PROPERTIES OF GRAPHITE/POLYIMIDE COMPOSITE MATERIALS
Donald R. Rummler and Ronald K. Clark *In its* Graphite/Polyimide Composites Aug. 1979 p 289-302 refs (For primary document see N79-30297 21-24)
Avail: NTIS HC A19/MF A01 CSCL 11D

An on-going program to characterize advanced composites for up to 50,000 hours of exposure to simulated supersonic cruise environments is summarized. Results are presented for up to 25,000 hours of thermal exposure and 10,000 hours of flight simulation at temperatures up to 560K (550 F) with emphasis on HTS/710 graphite/polyimide composite material. Results to date indicate that the maximum use temperature for

HTS/710 may be reduced to 505K (450 F) for long-time (1000 hours) application such as the supersonic transport. Preliminary thermophysical properties data for HTS/PMR15 graphite/polyimide were generated. These data include thermal conductivity, thermal expansion, and specific heat from 115K (-252 F) to 590K (600 F) and emittance at room temperature and 590K (600 F). The purpose in generating these data was to validate use of state-of-the-art property measurement methods for advanced graphite fiber reinforced resin matrix composites. Based on results to this point, thermal expansion measurements for composites are most difficult to perform. A high degree of caution in conducting thermal expansion tests and analyzing results is required to produce reliable data. Author

N79-30318*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ANALYSIS METHODS AND PRELIMINARY DESIGN STUDY
C. L. Blackburn (Tennessee Univ. at Nashville) and J. C. Robinson *In its* Graphite/Polyimide Composites Aug. 1979 p 303-318 refs (For primary document see N79-30297 21-24)
Avail: NTIS HC A19/MF A01 CSCL 11D

The shuttle orbiter body flap was studied to define loads and temperatures and to assess various structural concepts. Laminated-structure analysis capability was required. An appraisal of the available structural analysis programs, NASTRAN and SPAR, indicates that neither had all the capabilities required. The thermal analysis program, MITAS solved the problem once a model was generated but model generation and verification was laborious and transfer of temperatures to the structural program usually required interpolation. Therefore it was decided to incorporate both capabilities in the SPAR finite element program. S.E.S.

N79-30319*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DESIGN CONSIDERATIONS FOR COMPRESSION PANELS AT ELEVATED TEMPERATURE
Robert R. McWithey, Charles J. Camarda, and Gerald G. Weaver (Delaware Univ.) *In its* Graphite/Polyimide Composites Aug. 1979 p 319-337 refs (For primary document see N79-30297 21-24)
Avail: NTIS HC A19/MF A01 CSCL 11D

The potential of graphite/polyimide is assessed on graphite/polyimide honeycomb sandwich panels and stiffened panel concepts to develop lightweight panels for use at elevated temperatures. The capability is attained to correctly predict panel buckling behavior and panel strength at elevated temperatures. S.E.S.

N79-30320*# Hexcel, Dublin, Calif.
GLASS POLYIMIDE HONEYCOMB CORES FOR ADVANCED SPACE TRANSPORTATION SYSTEMS
Jay Brentjes *In* NASA. Langley Res. Center Graphite/Polyimide Composites Aug. 1979 p 339-359 refs (For primary document see N79-30297 21-24)
(Contract NAS1-15356)
Avail: NTIS HC A19/MF A01 CSCL 11D

The use of a glass fiber reinforced polyimide honeycomb was considered for various applications requiring lightweight stiff structures which may experience temperatures up to 600K. The experiences and results of fabricating these core types are reported. The process parameters and most desirable characteristics are noted. The differences in considering resins for making laminates versus their use in surface coatings are stressed. This comparison is made to explain the problems encountered in using the three new resin types for dipping honeycomb to the desired density. Some properties and the effect of post cure, forming and ventilating techniques for the condensation polyimide core types are presented. S.E.S.

N79-30321*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
HPLC FOR QUALITY CONTROL OF POLYIMIDES
Philip R. Young and George F. Sykes *In its* Graphite/Polyimide Composites Aug. 1979 p 361-373 (For primary document see N79-30297 21-24)
Avail: NTIS HC A19/MF A01 CSCL 11D

High Pressure Liquid Chromatography (HPLC) as a quality control tool for polyimide resins and prepregs are presented. A data base to help establish accept/reject criteria for these materials was developed. This work is intended to supplement, not replace, standard quality control tests normally conducted on incoming resins and prepregs. To help achieve these objectives, the HPLC separation of LARC-160 polyimide precursor resin was characterized. Room temperature resin aging effects were studied. Graphite reinforced composites made from fresh and aged resin were fabricated and tested to determine if changes observed by HPLC were significant. S.E.S.

N79-30322*# Boeing Aerospace Co., Seattle, Wash.
QUALITY ASSURANCE OF PMR-15
A. B. Hunter *In* NASA. Langley Res. Center Graphite/Polyimide Composites Aug. 1979 p 375-390 (For primary document see N79-30297 21-24)
Avail: NTIS HC A19/MF A01 CSCL 11D

Controls on the PMR-15 resin and/or prepreg were established to ensure a solid base for the subsequent process development task. The effort was divided into subtasks which included evaluation of commercially available graphite/PMR-15 polyimide prepregs, detailed evaluation of materials and selection of chemical test procedures. During the initial phase of the program a variability problem was detected in the PMR-15 resin. The manufacturing and/or storage of the PMR-15 resin/esters was identified as the chief cause for the variability. R.E.S.

N79-30323*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RECENT DEVELOPMENTS IN PMR POLYIMIDES AT NASA LEWIS
T. T. Serafini *In* NASA. Langley Res. Center Graphite/Polyimide Composites Aug. 1979 p 391-412 refs (For primary document see N79-30297 21-24)
Avail: NTIS HC A19/MF A01 CSCL 11D

The following areas of PMR polyimide research were reviewed: (1) prepreg tack and drape; (2) cure temperature; (3) solution characterization; and (4) elevated temperature composite properties. Recent hardware applications of PMR-15 by various fabricators were also reviewed. R.E.S.

N79-30324*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
HIGH TEMPERATURE POLYMER RESEARCH AT NASA LANGLEY
Terry L. St.Clair *In its* Graphite/Polyimide Composites Aug. 1979 p 413-430 refs (For primary document see N79-30297 21-24)
Avail: NTIS HC A19/MF A01 CSCL 11D

Toughness properties of existing and modified resins were investigated for adhesive and matrix resin applications. Crosslinking systems, scale-up and screening, and the stability and processability of matrix resins were also investigated. R.E.S.

N79-30325*# General Dynamics/Convair, San Diego, Calif.
GRAPHITE/POLYIMIDE STATE-OF-THE-ART
William G. Scheck *In* NASA. Langley Res. Center Graphite/Polyimide Composites Aug. 1979 p 431-434 (For primary document see N79-30297 21-24)
Avail: NTIS HC A19/MF A01 CSCL 11D

A brief overview of potential applications and problems associated with graphite/polyimide composites is presented. Author

N79-30326*# Boeing Aerospace Co., Seattle, Wash.
GRAPHITE/POLYIMIDE STATE-OF-THE-ART PANEL DISCUSSION
Morton Kushner *In* NASA. Langley Res. Center Graphite/Polyimide Composites Aug. 1979 p 435-439 (For primary document see N79-30297 21-24)
(Contract NAS1-15009)
Avail: NTIS HC A19/MF A01 CSCL 11D

Assessment of current graphite/polyimide composite technology is presented. Work in reducing material variability, developing a broader design data base and scale-up details are seen as requirements for future research efforts. R.E.S.

N79-30327*# Rockwell International Corp., Canoga Park, Calif.
GRAPHITE/POLYIMIDE STATE-OF-THE-ART PANEL DISCUSSION
William H. Morita *In* NASA. Langley Res. Center Graphite/Polyimide Composites Aug. 1979 p 441-333 (For primary document see N79-30297 21-24)
Avail: NTIS HC A19/MF A01 CSCL 11D

The state-of-the-art of graphite/polyimides (GR/PI) composites is presented under two related subject areas: technical roadblocks to increased application and priority of technical problems. Technical roadblocks are the maturity of the 589K GR/PI material system and GR/PI structure fabrication technology. Priority of the GR/PI technical problems involves the selection of a primary polyimide resin system to reduce the scope of development problems. The GR/PI structure first priority problem is the selection and development of high temperature adhesive systems. Author

N79-30328*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
GRAPHITE/POLYIMIDES STATE-OF-THE-ART PANEL DISCUSSION
Robert C. Curley *In* NASA. Langley Res. Center Graphite/Polyimide Composites Aug. 1979 p 445-450 (For primary document see N79-30297 21-24)
Avail: NTIS HC A19/MF A01 CSCL 11D

A brief overview of current and planned applications of graphite/polyimide composites is presented. A short discussion of technical problems delaying the application of graphite polyimide composites in aerospace structures and near-term solutions to these problems are also included. Author

N79-30329*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
GRAPHITE/POLYIMIDE STATE-OF-THE-ART PANEL DISCUSSION
Clayton A. May *In* NASA. Langley Res. Center Graphite/Polyimide Composites Aug. 1979 p 451-454 (For primary document see N79-30297 21-24)
Avail: NTIS HC A19/MF A01 CSCL 11D

A technology assessment of graphite/polyimide composites is presented. Technology applications in the aerospace industry and the problems in processing relative to their application are discussed. R.E.S.

N79-30330# Stevens Inst. of Tech., Hoboken, N. J. Dept. of Materials and Metallurgical Engineering.
ASSESSMENT OF THE CORROSIVENESS OF CELLULOSIC INSULATING MATERIALS
R. Weil and A. Graviano Oak Ridge, Tenn. ORNL Jun. 1979 29 p refs Prepared for ORNL
(Contract W-7405-eng-26)
(ORNL/SUB-7556/1) Avail: NTIS HC A03/MF A01

Information which is available about the corrosiveness of cellulose and other related properties is reviewed and discussed. A survey of the literature dealing with the corrosiveness of wood products other than cellulose and of the corrosiveness in other media by fire retardant chemicals generally used with cellulosic insulation is included. The types of corrosion which could be caused by cellulosic insulation are also briefly discussed. Recommendations are made to either improve the present corrosion testing procedure and to establish a relationship of the improved test to field conditions or to design a new accelerated corrosion test. Other recommendations include: (1) the development of a testing method which requires less time and is more quantitative; (2) research to find less corrosive retardants and substitutes for presently used ones which may be in short supply in the future; (3) the development of better fire retardants; and (4) the establishment of a repository of data on corrosiveness of cellulose. R.E.S.

N79-30331# Army Armament Research and Development Command, Watervliet, N. Y. Benet Weapons Lab.
REFRACTORY-LINED COMPOSITE PRESSURE VESSELS
G. Dandrea, R. L. Cullinan, and P. J. Croteau Dec. 1978 85 p refs
(AD-A069617; AD-E440028; ARLCB-TR-78023) Avail: NTIS HC A05/MF A01 CSCL 11/2

Refactory lined pressure vessels, possessing good corrosion and erosion resistance at low and high temperatures, seem to be ideal for extending the wear life of conventional gun tubes. Since refractory materials exhibit high compressive and low tensile strength, prescribed residual stresses must be introduced to eliminate the significant tensile stresses produced during firing. The prominent problem in fabricating such vessels is to restrict the refractory material from expanding axially during the application of the residual stresses. This report presents manufacturing procedures to prevent the axial expansion; theoretical and experimental analyses predicting the residual and firing stress state in the vessel; and test results on 12.5 mm and 60 mm ceramic liners. Preliminary work on 6.4 mm tungsten-carbon alloy is also reported. GRA

N79-30332# Naval Research Lab., Washington, D. C.
HIGH PERFORMANCE COMPOSITES AND ADHESIVES FOR V/STOL AIRCRAFT Annual Report, 1 Sep. 1977 - 30 Nov. 1978
Luther B. Lockhart, Jr. 23 May 1979 163 p
(SF54502001)
(AD-A069611; NRL-MR-4005; AR-3) Avail: NTIS HC A08/MF A01 CSCL 11/2

An interdisciplinary program has been undertaken to address the composite and adhesive materials requirements of V/STOL aircraft. The primary tasks are to develop and characterize high modulus, high toughness resins with use temperatures of 350 F to 450 F or higher, to develop fabrication technology of newly developed resin matrices for graphite-fiber reinforced composites, to develop composite failure criteria for design optimization and to establish appropriate quality control parameters. This report is the third annual review of the program, covering the period 1 September 1977 to 30 November 1978. The reporting period was extended to permit completion of an important phase of the task on fracture behavior of composites. During the reporting period, two of the original tasks, Resin Synthesis and Radiation Curing, were terminated but related work is being continued under other in-house projects to follow up leads developed in this program. Among recent accomplishments are the demonstration that resin fracture energy can affect composite interlaminar toughness in fiber-reinforced composites, the development of quality control methodology for phthalocyanine precursor resins, the successful fabrication of phthalocyanine/graphite fiber composites from prepreg, and the completion of room temperature fracture tests of NARMCO 5208/T300 composite over four quadrants of load space and Hexcel F178/T300 composite in one quadrant and further verification of the ability to use this data to predict failure in a box-beam structure. GRA

N79-30333# ARO, Inc., Arnold Air Force Station, Tenn.
AEROTHERMODYNAMIC EVALUATION OF CANDIDATE MATERIALS FOR SRAAM-TYPE MISSILE SYSTEMS Final Report
J. O. Ievalts AEDC 11 Oct. 1978 29 p refs
(AF Proj. 2417)
(AD-A069874; AEDC-TSR-78-V42) Avail: NTIS HC A03/MF A01 CSCL 11/4

A materials screening test was conducted in the von Karman Gas Dynamics Facility Hypersonic Wind Tunnel C to determine the performance of several materials considered for potential use as missile control surfaces and fuselage body panels. The materials samples were tested using the wedge technique. Test conditions were representative of the aerothermal environment encountered during a typical missile flight profile. Twenty-seven material specimens were tested with photographic coverage being the primary data. Selected results are presented to illustrate the test techniques and to show typical data obtained. GRA

N79-30334# Grumman Aerospace Corp., Bethpage, N.Y.
METALLIC COATINGS FOR GRAPHITE/EPOXY COMPOSITES Final Report, 1 May 1977 - 31 Oct. 1978
Christian J. Staebler, Jr. and Bonnie F. Simpers May 1979 91 p refs
(Contract N00019-77-C-0250)
(AD-A069871) Avail: NTIS HC A05/MF A01 CSCL 11/2

Metallic coating systems for graphite/epoxy laminated aircraft structures were developed to provide protection against moisture penetration, electromagnetic interference (EMI), paint strippers

and lightning strikes. Foil coatings and metal-filled resin coatings were evaluated to assess the protection ability in each of these areas. The foil coatings provided a significant reduction in the moisture penetration and the associated strength loss of the laminate after exposure to humidity and humidity-thermal spiking. Two techniques were developed for the application of foil coatings to graphite/epoxy laminates. Solid aluminum foil was applied to cured laminates in a secondary bonding operation. Perforated aluminum foil was bonded to the laminate in a co-curing operation. The co-curing application required that the laminate be prebled prior to application of the foil and final co-curing to obtain the optimum strength and thickness of the laminate. GRA

N79-30335# General Dynamics/Convair, San Diego, Calif.
ULTRA-HIGH-MODULUS GRAPHITE-EPOXY CONICAL SHELL DEVELOPMENT, SUPPLEMENT Final Report, 1 Dec. 1976 - 30 May 1978
Julius Hertz, Edward E. Spier, and Norman R. Adsit Apr. 1979 73 p refs
(Contract DAAG46-76-C-0008; DA Proj. 1W1-62113-A-661)
(AD-A069795; CASD-ASC-78-001; AMMRC-TR-78-38-Suppl) Avail: NTIS HC A04/MF A01 CSCL 11/2

The work reported herein represents a preliminary evaluation of support ring concepts for an advanced terminal interceptor (ATI). An ultra-high-modulus grahite/epoxy subscale cone was fabricated and a wedge shaped ring was secondary bonded internally. The cone and ring were successfully tested beyond ultimate load at both RT and 325F. A unique helicoil attachment concept for transferring load into the ring was demonstrated. GRA

N79-30336# Illinois Univ., Urbana.
EFFECT OF NEUTRON IRRADIATION ON THE DENSITY OF LOW-ENERGY EXCITATIONS IN VITREOUS SILICA Ph.D. Thesis
Terry Lee Smith 1979 173 p refs
(Contract EY-76-C-02-1198)
(COO-1198-1251) Avail: NTIS HC A08/MF A01

Systematic low-temperature measurements of the thermal conductivity, specific heat, dielectric constant, and temperature dependent ultrasound velocity were made on a single piece of vitreous silica. These measurements were repeated after fast neutron irradiation of the material. It was found that the irradiation produced changes of the same relative magnitude in the low-temperature excess specific heat C/sub ex/, the thermal conductivity kappa, and the anomalous temperautre dependence of the ultrasound velocity delta v/v. A corresponding change in the temperature dependent dielectric constant was not observed. It is therefore likely that kappa and delta v/v are determined by the same localized excitations responsible for C/sub ex/, but the temperature dependence of the dielectric constant may have a different, though possibly related, origin. A consistent account for the measured C/sub ex/, kappa, and delta v/v of unirradiated silica is given by the tunneling-state model with a single, energy-dependent density of states. Changes in these three properties due to irradiation can be explained by altering only the density of tunneling states incorporated in the model. DOE

N79-30337# California Univ., Livermore. Lawrence Livermore Lab.
FIBER COMPOSITE MATERIALS SYSTEMS
T. T. Chiao 30 Mar. 1979 12 p Presented at 5th SAMPE Educational Seminar, Palo Alto, Calif., 26 Jan. 1979
(Contract W-7405-eng-48)
(UCID-18092) Avail: NTIS HC A02/MF A01

The major classes of composite matrices are summarized. Elastic properties, strength, thermal-physical properties, stress rupture, fatigue, creep, fracture resistance, fracture toughness, thermal expansion, fiber content and distribution, matrix effects, and component quality of composites are briefly described. DOE

N79-30338# Sandia Labs., Albuquerque, N. Mex.
COMPARATIVE TRANSITION PERFORMANCE OF SEVERAL NOSETIP MATERIALS AS DEFINED BY BALLISTICS-RANGE TESTING
D. C. Reda 1979 25 p refs Presented at 25th ISA Intern. Instrumentation Symp., Anaheim, Calif., 7 May 1979
(Contract EY-76-C-04-0789)
(SAND-78-1859C; Conf-790505-12) Avail: NTIS HC A02/MF A01

Requirements and techniques for conducting aerthermodynamic nosetips/materials in hypersonic ballistics-range environments (ISA 22nd IIS), and associated data interpretation/analyses methods using interactive graphics (ISA 24th IIS) are outlined. From an aerothermodynamics standpoint, experimental results serve to test the validity of existing computer codes/correlations, as well as to expand the data base necessary for the generation of improved predictive techniques. From a materials-development standpoint, results serve to define relationships between fabrication/processing methods and associated material thermal response as well as to provide for relative ranking of candidate materials under controlled reentry conditions. Ballistic-range tests of preablated graphite and carbon/carbon composite nosetips were conducted. Results are presented which illustrate the comparative transition performance of five nosetip materials from both mean and statistical (degree-of-asymmetry) viewpoint. DOE

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N79-30339# National Bureau of Standards, Washington, D. C. Surface Science Div.
INFRARED SPECTROSCOPIC STUDY OF ACTIVATED SURFACE PROCESSES: CO CHEMISORPTION ON SUPPORTED RH
John T. Yates, Jr., T. Michael Duncan, and Robert W. Vaughan Apr. 1979 29 p refs Prepared in cooperation with Calif. Inst. of Tech., Pasadena
(Contracts N00014-79-F-0014; N00014-75-C-0960)
(AD-A069734; TR-12) Avail: NTIS HC A03/MF A01 CSCL 07/4

The infrared spectrum of CO chemisorbed on alumina-supported Rh surfaces has been studied following chemisorption at cryogenic temperatures. Major differences are observed in the distribution and spectroscopic character of chemisorbed CO species produced at low temperatures (110-170K) compared to chemisorbed CO species produced on Rh at 295K. It has been found that the species Rh(CO)2, formed on isolated Rh sites, is produced rapidly via an activated chemisorption process above about 200K. On more 'crystalline' Rh(x) sites, containing chemisorbed CO, an activated CO-adsorbate-conversion process has been detected in which nu sub CO decreases by about 50/cm on warming the adsorbed layer above approx. 265K. Isotopic exchange between about 13CO(g) and 12CO has been shown to occur rapidly at low temperature (approx. 200K) for Rh(CO)2 species, whereas Rh(x)(CO) species exchange rapidly only at higher temperatures (approximately > - 250K). These results, taken together, serve to confirm a model in which isolated Rh sites coexist on the alumina support with crystalline Rh (x) sites; the two kinds of sites are separable on the basis of the spectroscopic character of the chemisorbed CO species they adsorb as well as by means of their chemical properties. GRA

N79-30340# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
WITTIG SYNTHESIS OF ALLYLIC ORGANOSILICON COMPOUNDS Interim Technical Report
Dietmar Seyferth, Karl R. Wursthorn, Thomas F. O. Lim, and Dennis J. Sepelak 1 Jun. 1979 28 p refs Submitted for publication
(Contract N00014-76-C-0837; NR Proj. 053-618)
(AD-A069478; ITR-5) Avail: NTIS HC A03/MF A01 CSCL 07/3

The reactions of Beta-silylalkylidenetriphenylphosphoranes, prepared by the action of alkylidenetriphenylphosphoranes on iodomethyl-silicon compounds, followed by deprotonation of the resulting Beta-silylalkyltriphenylphosphonium iodides, with

aldehydes and ketones provide a useful route to allylic silicon compounds. GRA

N79-30341# California Univ., Berkeley. Lawrence Berkeley Lab.
CATALYSIS BY PLATINUM SINGLE CRYSTAL SURFACES: LOW PRESSURE HYDROCARBON REACTIONS AND THE EFFECTS OF INTRODUCING STRONGLY BOUND OXYGEN AT THE SURFACE Ph.D. Thesis
Carol Ellen Smith Jul. 1978 184 p refs
(Contract W-7405-eng-48)
(LBL-8044) Avail: NTIS HC A09/MF A01

The dehydrogenation of cyclohexene and cyclohexane, and the hydrogenation of cyclohexene were studied on the clean and preoxidized surfaces of three platinum single crystals. The choice of reaction conditions is discussed with respect to detection limits and the variation of the catalyst reactivity with reagent pressures and catalyst temperature; the reactions were carried out using flow conditions at low pressure at a platinum temperature of 150 C. Oxygen coverages were monitored by Auger electron spectroscopy. Low coverages of strongly bound oxygen enhanced the rates of the dehydrogenation and hydrogenation reactions, and changed the selectivity of cyclohexene dehydrogenation to benzene over hydrogenation to cyclohexane. These effects of preoxidation on catalytic rates and selectivity were found to be sensitive to the structure of the platinum surface. DOE

N79-30342# Sandia Labs., Albuquerque, N. Mex.
HYDROGEN CONCENTRATION PROFILES AND CHEMICAL BONDING IN SILICON NITRIDE
P. S. Peercy, H. J. Stein, B. L. Doyle, and S. T. Picraux 1978 22 p refs Presented at 20th Electron. Mater. Conf., Santa Barbara, Calif., 28 Jun. 1978 Submitted for publication
(Contract EY-76-C-04-0789)
(SAND-78-0404C; Conf-780686-1) Avail: NTIS HC A02/MF A01

The complementary technique of nuclear reaction analysis and infrared absorption was used to study the concentration profile and chemical bonding of hydrogen in silicon nitride for different preparation and annealing conditions. Comparison of nuclear reaction analysis and infrared absorption measurements after isothermal annealing shows that all of the hydrogen retained in the films remains bonded to either silicon or nitrogen and that hydrogen release from the material on annealing is governed by various trap energies involving at least two N-H and one Si-H trap. Estimates of the hydrogen release rates can be made from the effective diffusion coefficient obtained from measurements of hydrogen migration in hydrogen implanted and annealed films. DOE

N79-30343# Sandia Labs., Livermore, Calif.
PRECOMBUSTION FUEL/AIR DISTRIBUTION IN A STRATIFIED CHARGE ENGINE USING LASER RAMAN SPECTROSCOPY
S. C. Johnston Mar. 1979 33 p refs Presented at the 1979 SAE Automotive Eng. Congr. and Exposition, Detroit, Feb. 1979
(Contract EY-76-C-04-0789)
(SAND-78-8707; Conf-790216-3) Avail: NTIS HC A03/MF A01

Continuous wave laser Raman spectroscopy was applied to determine precombustion fuel/air distribution in a motored, direct injected, stratified charge engine. Point measurements of the mean, gas phase fuel/air ratio across a diameter in the combustion chamber for a single set of engine operating parameters were obtained along with flow visualization records of the injection mixing process for both liquid and gas phase fuel injection. Results show that large spatial variations in the fuel/air ratio occur in the cylinder during and after fuel injection. Near top-dead-center, fuel/air mixing was nearly complete, but the distribution across the cylinder diameter still exhibited a region of relatively low fuel concentration. DOE

N79-30344# Swedish Water and Air Pollution Research Lab., Stockholm.
SLOPE OF GRAN'S PLOT: A USEFUL FUNCTION IN THE EXAMINATION OF PRECIPITATION, THE WATER-SOLUBLE PART OF AIRBORNE PARTICLES, AND LAKE WATER
Ying-Hua Lee and Cyril Brosset Jun. 1978 30 p refs
(IVL-B-442) Avail: NTIS (US Sales Only) HC A03/MF A01; DOE Depository Libraries

In order to find out how much information that can be obtained from an acid-base titration by using the slope of Gran's plot, the titration technique was refined and applied to samples of precipitation, leaching solutions of airborne particles, and lake water. The results indicate a possibility in certain cases of determining from an accurate measurement of the slope of the plot, the dissociation constant and concentration of the acids present. DOE

N79-30345# Argonne National Lab., Ill.
SEPARATION OF METAL IONS BY ANION EXCHANGE IN MIXTURES OF HYDROCHLORIC ACID AND HYDROFLUORIC ACID
J. P. Faris Dec. 1978 67 p refs
(Contract W-31-109-eng-38)
(ANL-78-78) Avail: NTIS HC A04/MF A01

Distribution coefficients were determined for the adsorption of more than 40 elements on anion exchange resins from mixtures of HCl(0.1 to 12M) and HF (0.1-8M). Two resins, Dowex 1 by 10, 200 to 400 mesh and Dowex 1 by 4, 100 to 200 mesh, were used. Distribution coefficients were also determined for the adsorption of many elements on both resins from 0.1 to 12M HCl and 0.1 to 12M HF. Anion exchange in the presence of HF was found useful for separating impurities from various materials for their subsequent determination, and specific procedures used in the spectrochemical laboratory for this purpose are outlined. The results of a literature search on the use of anion exchange in hydrofluoric acid and fluoride-containing media are presented. DOE

N79-30346# Bruker Physik A.G., Karlsruhe (West Germany).
DEVELOPMENT OF AN AUTOMATED HIGH RESOLUTION NUCLEAR MAGNETIC RESONANCE SPECTROMETER Final Report
Bruce L. Hawkins and Horst Schneiders Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1977 80 p refs In GERMAN; ENGLISH summary
(Contract BMFT-NT-28)
(BMFT-FB-T-77-78) Avail: NTIS HC A05/MF A01; ZLDI, Munich DM 16,40

Modern NMR-spectrometers generally work in the Fourier mode. Digital mini-computers are an integral part of such spectrometers. The automation of the spectrometer functions is described. A frequency coherent spectrometer system with automatic field-frequency-lock, computer controlled parameter adjustment, and optimization of field homogeneity was developed. The concept allows for spectral measurements to be made automatically without the interference of an operator.
Author (ESA)

N79-30347# Battelle Inst., Frankfurt am Main (West Germany).
INVESTIGATIONS INTO THE ELECTRODEPOSITION OF DISPERSION LAYERS UNDER ZERO-g CONDITIONS Final Report
Josef Ehrhardt Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1977 102 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-574)
(Contract BMFT-WRT-1075; DFVLR-BPT-01-QV-225-V22)
(BMFT-FB-W-77-11) Avail: NTIS HC A06/MF A01; ZLDI, Munich DM 21

A number of experiments, to be conducted onboard Spacelab, are proposed for investigating the mechanisms of dispersion deposition. Galvanically deposited dispersion layers (metal layers containing non-metallic particles) are shown to have applications in solving materials problems of wear and corrosion. Beginning with a comprehensive survey of the literature, the behavior of particles suspended in an electrolyte, moving towards a cathode, and during their incorporation into a deposition layer is discussed. Finally, reasons are given, involving the negative effects of a strong gravitational field on this work, why the spacelab must be used and the eventual experimental setup is described.
Author (ESA)

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N79-30348 British Library Lending Div., Boston Spa (England).
PERFECTION AND INTENSIFICATION OF ZINC ELECTROLYSIS WHEN APPLYING REVERSE CURRENT
Charisonov May 1979 14 p Transl. into ENGLISH from Freiberg. Forschungsh., B (East Ger.), v. 196, 1977 p 33-41
(BLL-RTS-11557) Avail: British Library Lending Div., Boston Spa, Engl.

A technique was developed for increasing the electrodeposition of zinc per unit of plating area using reverse currents. The analysis carried out on the technical characteristic processes in zinc refineries producing zinc according to the hydrometallurgical method, showed that the current density varies between 300 to 600 A/squared meters whereby the duration of zinc deposition on a cathode period lasted approximately 24 hours. M.M.M.

N79-30349 British Library Lending Div., Boston Spa (England).
INVESTIGATION OF INHIBITING AND SMOOTHING EFFECTS OF ORGANIC ADDITIVES TO BRIGHT NICKEL PLATING BATHS BY MEANS OF CURRENT DENSITY/POTENTIAL CURVES, PART 1
G. Dreben and H. Wagner May 1979 13 p refs Transl. into ENGLISH from Metalloberflaeche (West Ger.), v. 32, no. 9, 1978 p 334-337
(BLL-RTS-11590) Avail: British Library Lending Div., Boston Spa, Engl.

An investigation on the inhibition of electrochemical nickel deposition is presented. Known organic compounds were selected and tested singly or in combinations. Systematic correlations for the additives and combinations of additives with the measured current density/potential curves are presented and compared with results available from the literature. The dependence of the smoothing effect on the inhibition which can be measured by means of current density/potential curves is demonstrated for a commercial bright nickel plating bath. M.M.M.

N79-30350 British Library Lending Div., Boston Spa (England).
INFLUENCE OF PHYSICO-CHEMICAL CONDITIONS ON THE ELECTRODEPOSITION OF ZINC
Z. Gorlich and K. Ryczaj-Ryczek May 1979 15 p refs Transl. into ENGLISH from Rudy Metale (Poland), v. 23, no. 2, 1978 p 80-83
(BLL-RTS-11593) Avail: British Library Lending Div., Boston Spa, Engl.

Research conducted with solutions in which the content of zinc and sulphuric acid corresponds to the range of concentrations of electrolytes most often encountered in the industrial method of producing zinc by electrolysis is discussed. Cathode current densities in the range 3-20 A/dm squared were used. Most attention is paid to the connection between current efficiency and the form of cathode deposit obtained and the relationships between these parameters and the electrolysis conditions. It was concluded that the principal cause of decreased yield of zinc in the form of monolithic metal is a tendency to form dendrites, depending on the degree of the electrolyte with anode slime. M.M.M.

N79-30351 British Library Lending Div., Boston Spa (England).
CORRELATION BETWEEN MECHANICAL BEHAVIOUR IN AN INERT MEDIUM AND THE BEHAVIOUR WITH CORROSION UNDER STRESS OF AUSTENITIC STAINLESS STEELS
D. Desjardins, M. C. Petit, B. Darrieutort, and J. Daret 7 Dec. 1978 18 p refs Transl. into ENGLISH from Mem. Sci. Rev. Met. (France), Apr. 1977 p 207-217
(BLL-Risley-TR-4005-(9091.9F)) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.

Research was carried out to show that the boundaries of the elastic and plastic fields are not evident in the case of austenitic stainless steels, and that there is a relationship between determining the limit using stress deformation tests carried out at low deformation speeds. It was concluded that crack propagation is the same regardless of the stress, is not modified by preliminary cold drawing, and it may result from a mechanism where anodic dissolving plays a major role. M.M.M.

N79-30352 British Library Lending Div., Boston Spa (England).
HYDROGEN-INDUCED STRESS-CORROSION CRACKING IN LOW ALLOY STEELS
J. Hickling 30 Jan. 1979 35 p refs Transl. into ENGLISH of conf. paper from Kraftwerk Union A. G., Erlangen, West Germany Presented at 4th MPA Seminar in Ser. Safety of the Pressure Boundary of Light Water Reactors, Stuttgart, Oct. 1978
(BLL-Risley-TR-4028-(9091.9F)) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.

The results of the autoclave tests on hardened specimens of reactor steels are presented. Only in one condition which does not occur in the materials of reactor components do these steels exhibit a susceptibility to H2 induced stress corrosion cracking (SCC). It was concluded that the SSC crack formation in welded specimens even at peak hardness only occurs in the case of extreme mechanical loading. M.M.M.

N79-30353 British Library Lending Div., Boston Spa (England).
CORROSION OF WELDED JOINTS IN HIGH-ALLOY STEELS, AND HOW TO PREVENT IT
Guenter Herbsleb 15 Jan. 1979 12 p Transl. into ENGLISH from Schweisstechnik (West Ger.), v. 31, no. 4, Apr. 1977 p 53-57
(BLL-Windscale-806-(9091.9F)) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.

Various ways of arresting the corrosion of high alloy steel welds are described. Included are: pickling after welding and sand blasting. M.M.M.

N79-30354*# Westinghouse Research and Development Center, Pittsburgh, Pa. Structural Behavior of Materials Dept.
DATA DEVELOPMENT FOR ASTM E24.06.02 ROUND ROBIN PROGRAM ON INSTABILITY PREDICTION
D. E. McCabe Aug. 1979 24 p
(Contract NAS1-15461)
(NASA-CR-159103) Avail: NTIS HC A02/MF A01 CSCL 11F

Basis data for use in an ASTM E24.06.02 task group round robin activity was developed. Compact specimens were made of 2024-T351, 7075-T651 aluminum alloys, and 304 stainless steel. All were 12.7 mm thick and planar dimension variables incorporated were for 1T, 2T and 4T sizes. Representative raw data for each material and specimen size are contained herein. R-curves plotted in terms of delta a physical and delta a effective are plotted for each material. M.M.M.

N79-30355*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TRANSVERSE AND LONGITUDINAL TENSILE PROPERTIES AT 760 C OF SEVERAL OXIDE DISPERSION STRENGTHENED NICKEL-BASE ALLOYS
Albert E. Anglin, Jr. 1979 24 p refs Presented at Meeting of the Metallurgical Soc. of the Am. Inst. of Mining, Metallurgical, and Petroleum Engineers, New Orleans, La., 18-20 Feb. 1979 (NASA-TM-79189; E-058) Avail: NTIS HC A02/MF A01 CSCL 11F

The transverse and longitudinal tensile properties of the oxide dispersion strengthened nickel base alloys MA-793, MA-754, MA-755E, and MA-6000E were determined at 760 C. Transverse tensile strengths were comparable to longitudinal strengths. Transverse ductility levels generally were less than two percent elongation. Both tensile and yield strengths increased with increasing strain rate over the range 0.001 to 0.05 per second. Ductility was not strain rate sensitive, but related to grain size and grain aspect ratio. The fracture mode of most alloys changed from transgranular for longitudinally oriented specimens to intergranular for transverse specimens. Transverse properties of DM MAR M-200 + Hf were also determined for comparison. Author

N79-30356*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE EROSION/CORROSION OF SMALL SUPERALLOY TURBINE ROTORS OPERATING IN THE EFFLUENT OF A

PFB COAL COMBUSTOR

G. R. Zellars, S. M. Benfold, A. P. Rowe, and C. E. Lowell 1979 27 p Presented at the Advanced Mater. for Alternate Fuel Capable Directly Fired Heat Engines Conf., Castine, Maine, 30 Jul. - 3 Aug. 1979; cosponsored by DOE and EPRI
(NASA-TM-79227; E-125) Avail: NTIS HC A03/MF A01 CSCL 11F

Superalloy turbine rotors in a single stage turbine with 6 percent partial admittance were operated in the effluent of a pressurized fluidized bed coal combustor for up to 164 hours. Total mass flow was 300 kg/hr and average particulate loadings ranged from 600 to 2800 ppm for several coal/sorbent combinations. A 5.5 atm turbine inlet gas pressure and inlet gas temperatures from 700 to 800 C yielded absolute gas velocities at the stator exit of about 500 m/s. The angular rotation speed (40,000 rpm) of the six inch diameter rotors was equivalent to a tip speed of about 300 m/s, and average gas velocities relative to the rotating surface ranged from 260 to 330 m/s at mean radius. The rotor erosion pattern reflects heavy particle separation with severe (5 to 500 cm/yr) erosion at the leading edge, pressure side center, and suction side trailing edge at the tip. The erosion distribution pattern provides a spectrum of erosion/oxidation/deposition as a function of blade position. This spectrum includes enhanced oxidation (10 to 100 x air), mixed oxides in exposed depletion zones, sulfur rich oxides in deposition zones, and rugged areas of erosive oxide removal. A.W.H.

N79-30357# Rockwell International Corp., Anaheim, Calif. Electronics Research Center.

TEMPERATURE SENSITIVE OPTICAL PHENOMENA IN HEAVY METAL HALIDE FILMS Final Technical Report, 19 Sep. 1977 - 31 Oct. 1978

J. D. McMullen, D. M. Heinz, F. S. Stearns, and B. R. Youmans 8 Jan. 1979 292 p refs
(Contract DAAK70-77-C-0165)
(AD-A069537; C79-8-501) Avail: NTIS HC A13/MF A01 CSCL 11/6

Films of PbI2 and HgI2 have been deposited on thin polymer and glass substrates. The thermal properties of the film materials were measured by a thermographic method to obtain thermal conductivity, heat diffusivity, and specific heat of the film materials. The temperature dependence of the absorption edge was measured between 0 C and 50 C for both materials and ranging down to -175 C for PbI2. These properties are needed in order to evaluate the potential application of each material as an absorption-edge-modulated transducer for thermal imaging. GRA

N79-30358# Air Force Materials Lab., Wright-Patterson AFB, Ohio.

THE INTERFEROMETRIC MEASUREMENT OF NEAR CRACK TIP DISPLACEMENTS IN A NICKEL BASE SUPERALLOY AT AMBIENT AND ELEVATED TEMPERATURES Final Report, Dec. 1976 - Apr. 1978

J. Wayne Jones Mar. 1979 87 p refs
(AF Proj. 2307)
(AD-A069648; AFML-TR-78-159) Avail: NTIS HC A05/MF A01 CSCL 11/6

An optical interferometric technique is used to measure the transverse displacement field in the vicinity of the tip of a fatigue crack. The feasibility of using such a technique at temperatures as high as 732 C is demonstrated. Measurements at the crack tip indicated a region of lateral constraint which is controlled in extent by the residual deformation field surrounding the crack tip. Real-time displacement measurements provide a means of evaluating the crack closure concept and indicate that the measurement of crack opening load from surface-based 'compliance' determinations leads to ambiguous results. The cyclic plastic zone within the monotonic plastic zone surrounding the crack tip is experimentally determined and compared with theory. GRA

N79-30359# Southern Univ., Baton Rouge, La. Dept. of Mechanical Engineering.

AN INVESTIGATION OF MECHANISMS EFFECTING ENVIRONMENTAL STRESS CRACKING IN TITANIUM ALLOY

Ira J. Graham 20 Jan. 1979 25 p refs
(Contract N00019-78-C-0065)
(AD-A069669) Avail: NTIS HC A02/MF A01 CSCL 11/6

The Acoustic Emission System has been able to detect and record crack growth in a titanium alloy (Ti6Al4V) under a less than critical stress intensity (K sub 1) in a methanol environment. The fracture mechanics concept was applied to the data obtained on the 25.4mm (1 inch) modified wedge-open-load (WOL) specimen with a constant-open-displacement (COD) crack. A closed-loop environment system contained the specimen, methanol and piezoelectric transducer for the duration of the crack propagation under the sustained load. The crack growth to cumulative emissions count (da/dn) shows a decreasing linear relationship to the stress intensity (K sub 1). GRA

N79-30360# Naval Research Lab., Washington, D. C. Thermostructural Materials Branch.

SURVEY OF POSTIRRADIATION HEAT TREATMENT AS A MEANS TO MITIGATE RADIATION EMBRITTLEMENT OF REACTOR VESSEL STEELS Progress Report

J. R. Hawthorne 14 Feb. 1979 34 p refs
(Contracts NRC-RES-79-103; NRC-03-76-0348)
(AD-A069705; AD-E000301; NRL-8287; NUREG-CR-0486)
Avail: NTIS HC A03/MF A01 CSCL 18/8

Postirradiation heat treatment (annealing) is being investigated as a method for the alleviation of radiation embrittlement to reactor vessel steels. Objectives of this study were to identify those service and metallurgical variables which can affect annealing response, to report data comparisons available for qualification of suspected influences, and to survey experimental results from commercially produced reactor materials and duplicate materials from the laboratory. Twelve factors are identified as having potential for affecting the postirradiation heat treatment response of low-alloy pressure vessel steels. A tentative qualification of six factors as significant contributing variables is made on the basis of experimental comparisons. Of these, heat-treatment temperature was observed to exert the largest influence on the embrittlement relief by annealing. The evidence indicates that a 399C heat treatment, but not a 343C heat treatment, is a practical and effective method for reducing and controlling radiation embrittlement in reactor vessels. GRA

N79-30361# Brown Univ., Providence, R. I. Engineering Div.

COMBINED MACROSCOPIC AND MICROSCOPIC APPROACH TO THE FRACTURE OF METALS Technical Progress Report, Jul. 1977 - Jun. 1978

J. Gurland, J. R. Rice, R. J. Asaro, and A. Needleman Jun. 1978 23 p refs
(Contract EY-76-S-02-3084)
(COO-3084-61) Avail: NTIS HC A02/MF A01

The work reported includes studies on: (1) the role of particles and interfaces in the initiation of fracture, including fundamentals of brittle versus ductile response of interfaces and observations on cavity growth by the cracking of grain or sub-grain boundaries adjacent to carbides in spheroidized steels: (2) environment sensitive fracture mechanisms, particularly the effect of hydrogen in reducing tensile ductility by acceleration of the crack-like mode of cavity growth along grain boundaries in steels; (3) models for elevated temperature diffusive processes of cavity growth on grain interfaces, including non equilibrium effects and crack-like growth modes; (4) localization of plastic deformation and the inception of ductile rupture; and (5) elastic-plastic stress analysis, by finite elements, of growing cracks and examination of criteria for stable crack growth. DOE

N79-30362# Sandia Labs., Albuquerque, N. Mex.

HYDROGEN INDUCED DUCTILITY LOSSES IN AUSTENITIC STAINLESS STEEL WELDS

John A. Brooks and A. J. West Jun. 1978 28 p refs
(Contract EY-76-C-04-0789)
(SAND-78-8675) Avail: NTIS HC A03/MF A01

The effect of hydrogen on the tensile behavior of austenitic stainless steel welds was studied in two AISI 300 series alloys and two nitrogen strengthened alloys. The microstructure of these welds typically contained several percent ferrite in an austenite matrix. Hydrogen was found to reduce the ductility of all welds; however, the severity of ductility loss decreased with increasing stacking fault energy, as observed in previous studies on wrought material. In the lowest stacking fault energy welds, 304L and 308L, hydrogen changed the fracture mode from simple rupture

to a mixed mode of ductile and brittle fracture associated with the austentic ferrite interface. Higher stacking fault energy welds, 309S and 22-13-5, showed smaller losses in ductility. In these materials hydrogen assisted the ductile rupture process by aiding void growth and coalescence, without changing the fracture mode. DOE

N79-30363# Wisconsin Univ., Stoughton. Synchrotron Radiation Center.

PHOTONS AS A PROBE OF HYDROGEN IN METALS: PHOTOELECTRON AND OPTICAL STUDIES

J. H. Weaver 1979 12 p refs Presented at Workshop on Analysis of Hydrogen in Solids, Albuquerque, N. Mex., 23-25 Jan. 1979

(Contract W-7405-eng-82)

(IS-M-186; Conf-790127-3) Avail: NTIS HC A02/MF A01

Optical and photoelectron spectroscopy results for Nb, NbHSub x/ and YH/sub x/ are presented as representative of d-band metals, monohydrides and dihydrides. The results are interpreted in terms of Switendick's model for metal-hydrogen interaction and give clear evidence for general accuracy of that model of the electronic structure of hydrides. DOE

N79-30364# Aluminum Co. of America, Alcoa Center, Pa. Alcoa Labs.

PRODUCTION OF ALUMINUM-SILICON ALLOY AND FERROSILICON AND COMMERCIAL PURITY ALUMINUM BY THE DIRECT REDUCTION PROCESS, PHASE B Interim Technical Report, 1 Sep. - 30 Nov. 1978

M. J. Bruno Dec. 1978 19 p

(Contract EC-77-C-01-5089)

(CONS-5089-5; ITR-1) Avail: NTIS HC A03/MF A01

The parameters of charge content, reaction temperatures and residence time were studied in a bench reactor concerning the production of Al-Si and Fe-Si alloys. Results confirmed that minimum final stage reaction temperature is 1950 to 2000 C. Residence time varied with initial charge concentration. Fe2O3 additions to the charge produced a significant increase in metallic yield. A burden preparation procedure was developed for making acceptable agglomerates containing Fe2O3, bauxite, clay and coke. Particle size distribution of starting materials was correlated with agglomerate strength. A new bench scale reactor was designed and built to facilitate semi-continuous operation, using O2 injection to burn coke supporting the burden, resulting in burden movement. The reactor operated smoothly as an iron blast furnace at 1500 C, demonstrating the validity of the equipment and test procedures. DOE

N79-30365# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.

POWDER METALLURGY DEVELOPMENT AT SRL

H. B. Peacock 1978 26 p Presented at the Meeting of Res. Reactor Fuel Designers, Developers and Fabricators, Argonne, Ill., 9 Nov. 1978

(Contract EY-76-C-09-0001)

(DP-MS-78-89; Conf-781151-3) Avail: NTIS HC A03/MF A01

Fuel for Savannah River Plant reactors consists of extruded tubes with aluminum-uranium alloy cores clad with 8001 aluminum. The U-235 in the fuel is periodically recovered and recycled in new fuel assemblies. The buildup of U-236 in the enriched uranium requires increased total uranium contents to maintain reactivity in existing assembly designs. High level waste production from these tubes is proportional to the aluminum content; therefore, appreciable radioactive waste reductions result from lower aluminum-uranium ratios and thinner clad tubes. The casting process now used for fuel cores is limited to below 40 wt % U because of the reduced fabricability of high uranium alloys. To increase tube loading and reduce aluminum, the U3O8-Al powder metallurgy (P/M) process for fuel tubes is under development. Several fabrication and irradiation tests were made using production conditions. Both small scale and production tests carried out for high-density P/M fuel development are discussed. DOE

N79-30366# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.

FRACTURE OF Fe-Cr-Mn AUSTENITIC STEEL

G. R. Caskey, Jr. 1979 22 p Presented at the AIME Ann. Meeting, New Orleans, 18 Feb. 1979

(Contract EY-76-C-09-0001)

(DP-MS-78-68; Conf-790219-3) Avail: NTIS HC A02/MF A01

Tensile tests of Tenelon (U.S. Steel), a nitrogen strengthened iron base alloy containing 18% chromium and 15% manganese, demonstrated that cleavage fracture can occur in some austenitic steels and is promoted by the presence of hydrogen. Tensile failure of Tenelon at 78 K occurred with no detectable necking at low strain levels. The fracture surface contained cleavage facets that lay along coherent twin boundaries oriented transversely to the tensile axis. Charging gaseous hydrogen at 679 MPa pressure and 650 K had no significant effect on the mechanical behavior or fracture mode at 78 K, but raised the ductile-to-brittle transition temperature from less than 200 K to about 250 K. DOE

N79-30367# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.

EVALUATION OF CREEP AND RELAXATION DATA FOR HASTELLOY ALLOY X SHEET

M. K. Booker Feb. 1979 69 p refs

(Contract W-7405-eng-26)

(ORNL-5479) Avail: NTIS HC A04/MF A01

Available creep, creep-rupture, and relaxation data for Hastelloy alloy X were collected and analyzed to yield mathematical representations of the behavior for design use. Emphasis is placed on application of the alloy to use as a prime structural material for the proposed Brayton isotope power system and the high temperature gas cooled reactor. DOE

N79-30368# Brookhaven National Lab., Upton, N. Y.

HYDROGEN ABSORPTION IN THE NIOBIUM-VANADIUM SYSTEM

M. A. Pick and D. O. Welch 1979 8 p refs Presented at the Hydrogen in Metals Intern. Meeting, Munster, W. Ger., 6 Mar. 1979

(Contract EY-76-C-02-0016)

(BNL-24234) Avail: NTIS HC A02/MF A01

The effect of dilute vanadium addition to niobium on hydrogen absorption was studied by measuring equilibrium pressure--composition--temperature data for a Nb + 6 at.% V alloy and by constructing a theoretical model of the effect of hydrogen trapping on phase equilibria in such systems. The results indicate the H-V binding energy is substantially smaller than thought previously. A depression of the alpha-alpha prime critical temperature is observed which, if interpreted in terms of trapping, leads to a H-V binding energy of approximately 0.04 eV. DOE

N79-30369# Argonne National Lab., Ill.

EFFECTS OF RADIATION-INDUCED SEGREGATION AND PREFERENTIAL SPUTTERING ON THE SPUTTERING RATE OF ALLOYS

N. Q. Lam, G. K. Leaf, and H. Wiedersich 1979 7 p refs Presented at the 1st Topical Meeting on Fusion Reactor Mater., Miami Beach, Fla., 29 Jan. 1979

(Contract W-31-109-eng-38)

(CONF-790125-3) Avail: NTIS HC A02/MF A01

Changes in the surface composition and in the sputtering rate of binary alloys were calculated using a kinetic model that includes the effects of radiation-induced segregation and preferential sputtering. Numerical solutions were obtained for two dilute Ni-based model alloys, Ni-Cu and Ni-Mo, under 5-keV Ar(+) ion bombardment as functions of sputtering time, temperature, and initial alloy composition. In the temperature range 200 to 850 C, the sputtering rate is initially affected by strong radiation-induced segregation. As the bombardment time increases, preferential sputtering becomes dominant; the surface composition and hence, the sputtering rate, approach the steady-state values determined entirely by the sputtering coefficients of the alloy components. Below 200 and above 850 C, the sputtering rate is controlled by preferential sputtering only because radiation-induced segregation is insignificant in these temperature regimes. DOE

N79-30370# European Space Agency, Paris (France).

INFLUENCE OF AGING TREATMENTS ON MECHANICAL

PROPERTIES OF TA6V
Marc Loubradou Apr. 1979 80 p refs Transl. into ENGLISH of 'Influence des Traitements de Revenu sur les Properties Mecaniques du TA6V', ONERA, Paris Report ONERA-NT-1978-2, 1978
(ESA-TT-550; ONERA-NT-1978-2) Avail: NTIS HC A05/MF A01

The structure at room temperature of quenched TA6V titanium alloy was investigated. This structure is alpha plus alphaprime or alpha plus beta according to the treatment temperature; it is always metastable. During aging, it was shown that the beta grains got decomposed along the reaction beta yields beta plus omega plus alpha yields beta plus alpha. This decomposition is accompanied by a large increase in the alloy elastic strength. No structural modification was observed alpha. A study performed on alpha and beta single-phase alloys having the compositions of the TA6V phases showed that the alpha hardness was insensitive to aging, while beta was much hardened by omega and alpha. It is deduced that the hardening of the minor phase beta during aging is responsible for a great part of the TA6V hardening. It is, however, difficult to state that it explains it completely. Author (ESA)

N79-30371# Hamburg Univ. (West Germany). Lehrstuhl fuer Ingenieurwissenschaften.
ANALYSIS OF THE POSSIBLE IMPROVEMENT OF ALLOYS BY DIRECTIONAL EUTECTIC SOLIDIFICATION UNDER ZERO-g CONDITIONS Final Report
Hans Ahlborn and Roediger Rothe Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1977 54 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-575)
(Contracts BMFT-WRT-1075; DFVLR-BPT-01-EO-434)
(BMFT-FB-W-77-15) Avail: NTIS HC A04/MF A01; ZLDI, Munich DM 13,50

Eutectic alloys having undergone directional solidification in a temperature gradient already in use, being developed and/or known from the literature were analyzed for their mechanical, electrical, magnetic, and optical properties. These characteristics were evaluated with respect to possible improvement through production in space. Results show that with the absence of thermal convection, which affects the formation of structures on earth, an improvement in the microstructure and hence in the properties of the alloys can be expected from zero gravity manufacture. It is anticipated that space processing in particular can bring advantages for eutectics whose properties are substantially influenced by the regularity of the structure, e.g. eutectics intended for optical applications. Author (ESA)

N79-30372# Brown, Boveri und Cie, A.G., Heidelberg (West Germany). Zentrales Forschungslabor.
INVESTIGATION OF THE SOLIDIFICATION BEHAVIOR OF ELECTRON BEAM WELDS UNDER MICROGRAVITATIONAL CONDITIONS
Hartmut Bogs, Peter R. Sahm, and Peter Hesse Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1977 103 p refs In GERMAN; ENGLISH summary Prepared in cooperation with Schweisstech. Lehr- u. Versuchsanstalt, Duisberg, West Ger. Report will also be announced as translation (ESA-TT-591)
(Contracts BMFT-WRT-1075; DFVLR-BPT-01-QV-375)
(BMFT-FB-W-77-40) Avail: NTIS HC A06/MF A01; ZLDI Munich DM 21,40

A survey of the literature was made in order to define a technique for the visualization of convection currents in an electron beam melt-channel and to identify the gravity dependent components of this convection phenomenon. Preliminary experiments with different steels were also conducted in order to show the influence of convection on microstructure and mechanical properties. Results are summarized in three proposals for further experimentation. These are electron beam welding of a transparent medium, i.e. quartz glass, to directly visualize convection phenomena, utilization of larger than 1g. values in order to extrapolate back to zero g behavior, and controlled experiments with Cr steels to measure the effect of convection on the mechanical properties and microstructure (quantitative metallography). Author (ESA)

N79-30373# Michigan Univ., Ann Arbor. Inst. of Science and Technology.
IMPACT ON ALUMINUM AND FERROUS INDUSTRIES OF ACCELERATING SUBSTITUTION OF ALUMINUM FOR IRON AND STEEL IN US AUTOMOTIVE PRODUCTION: A PRELIMINARY ANALYSIS
Lawrence T. Harbeck, Lawrence Crockett, Ruth L. Bardenstein, and Marian J. Krzyzowski 1978 105 p refs
(Grant EDA-06-06-01412)
(PB-295353/7; EDA-79-0101) Avail: NTIS HC A06/MF A01 CSCL 05C

The results are presented of a preliminary feasibility investigation that was undertaken to determine the economic potentials arising from an expected rapid expansion of aluminum usage in automotive applications and to evaluate the opportunities for meeting this increased demand through increased recycling of aluminum. Aluminum scrap supply trends, market and geographic requirements, energy, and transportation are among the factors studied. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N79-30374 British Library Lending Div., Boston Spa (England).
POLYMERS CROSSLINKABLE BY PHOTOPOLYMERIZATION
May 1979 20 p Transl. into ENGLISH of West German Patent no. 2125909, 14 Dec. 1972 20 p
(BLL-RTS-11651) Avail: British Library Lending Div., Boston Spa, Engl.

A process is described for manufacturing vinyl-groupco containing compounds with molecular weights greater than 1000. The disadvantages of prematrue crosslinking and oxygen sensitivity are avoided by homogeneously mixing Zerewitinoff-active hydrogen atom compounds with a solvent, and then in the presence of an acid catalyst, converting them at temperatures between -10 C and 140 C (preferably between 10 C and 120 C). containing compounds, possibly in mixture with further vinyl monomers, are used for the manufacture of coatings, which can be crosslinked, if necessary, by thermal or photochemical methods, with the additional utilization of photo-initiators. The product obtained can be used as varnishes and coatings, as well as in photocopying processes. A.R.H.

N79-30375*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN IMPROVED SYNTHESIS OF 2, 4, 8, 10-TEXTROXASPIRO (5.5)UNDECANE Patent Application
Algirdas C. Poshkus, inventor (to NASA) (NAS-NRC) Filed 3 Jul. 1979 12 p Sponsored by NASA
(NASA-Case-ARC-11243-1; US-Patent-Appl-SN-054502) Avail: NTIS HC A02/MF A01 CSCL 07D

Pentaery thritol is converted to its diformal, 2,4,8,10-tetrox aspiro (5.5) undecane, by heating it to a temperature within the range of about 110 to 150 C for a period of up to 10 minutes, in the presence of a slight excess of paraformaldehyde and of a catalytic quantity of an acid catalyst such as sulfuric acid. The reaction is carried out in two steps, by forming first the monoformal, then the diformal. The total reaction time is about 10 minutes and yield of diformal are greater than 90%. NASA

N79-30376*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
IMPROVED SYNTHESIS OF POLYFORMALS Patent Application
Algirdas C. Poshkus, inventor (to NASA) (NAS-NRC) Filed 3 Jul. 1979 9 p Sponsored by NASA
(NASA-Case-ARC-11244-1; US-Patent-Appl-SN-054501) Avail: NTIS HC A02/MF A01 CSCL 07C

Formals of $CH_2OH(CHOH)nCH_2$ polyols (n = 2 to 4) are prepared in less than 15 minutes by heating to about 125 C, a mixture of e.g. sorbitol and paraformaldehyde in slight excess (5 to 10%), in the presence of e.g. sulfuric acid in catalytic

quantities. Elution with methanol and filtration yield the pure solid cyclic triformal. The process can be carried in stages, using most stoichiometric quantities of paraformaldehyde, but without any change in overall heating time. NASA

N79-30377*# Horizons Research, Inc., Cleveland, Ohio.
SURVEY OF INORGANIC POLYMERS
Arthur H. Gerber and Eugene F. McInerney Jun. 1979 316 p refs
(Contract NAS3-21369)
(NASA-CR-159563; HRI-396) Avail: NTIS HC A14/MF A01 CSCL 07C

A literature search was carried out in order to identify inorganic, metallo-organic, and hybrid inorganic-organic polymers that could serve as potential matrix resins for advanced composites. The five most promising candidates were critically reviewed and recommendations were made for the achievement of their potential in terms of performance and cost. These generic polymer classes comprise: (1) Poly(arylsil sesquioxanes); (2) Poly(silyl arylene siloxanes); (3) Poly(silarylenes); (4) Poly (silicon-linked ferrocenes); and (5) Poly(organo phosphazenes). No single candidate currently possesses the necessary combination of physicomechanical properties, thermal stability, processability, and favorable economics. The first three classes exhibit the best thermal performance. On the other hand, poly (organo phosphazenes), the most extensively studied polymer class, exhibit the best combination of structure-property control, processability, and favorable economics. K.L.

N79-30378*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STATE-OF-THE-ART OF SiAlON MATERIALS
Sunil Dutta 1979 22 p refs Presented at 49th Meeting of the Structures and Materials Panel Including a Specialist Meeting on Ceramics for Turbine Engine Applications, Cologne Germany, 7-12 Oct. 1979; sponsored by AGARD
(NASA-TM-79207; E-092) Avail: NTIS HC A02/MF A01 CSCL 11G

Research presented includes work on phase relations, crystal structure, synthesis, fabrication, and properties of various SiAlONs. The essential features of compositions, fabrication methods, and microstructure are reviewed. High temperature flexure strength, creep, fracture toughness, oxidation, and thermal shock resistance are discussed. These data are compared to those for some currently produced silicon nitride ceramics to assess the potential SiAlON materials for use in advanced gas turbine engines. M.M.M.

N79-30379*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
BEND STRENGTHS OF REACTION BONDED SILICON NITRIDE PREPARED FROM DRY ATTRITION MILLED SILICON POWDER
T. P. Herbell and T. K. Glasgow 1979 14 p refs Presented at 3d Ann. Conf. on Composites and Advan. Mater., Merritt Island, Fla., 21-24 Jan. 1979; sponsored by Am. Ceram. Soc.
(Contract EC-77-A-31-1040)
(NASA-TM-79230; E-132; DOE/NASA/1040-79/8) Avail: NTIS HC A02/MF A01 CSCL 11G

Dry attrition milled silicon powder was compacted, sintered in helium, and reaction bonded in nitrogen-4 volume percent hydrogen. Bend strengths of bars with as-nitrided surfaces averaged as high as 210 MPa at room temperature and 220 MPa at 1400 C. Bars prepared from the milled powder were stronger than those prepared from as-received powder at both room temperature and at 1400 C. Room temperature strength decreased with increased milling time and 1400 C strength increased with increased milling time. Author

N79-30380*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANISOTROPIC FRICTION, DEFORMATION, AND FRACTURE OF SINGLE-CRYSTAL SILICON CARBIDE AT ROOM TEMPERATURE
Kazuhisa Miyoshi and Donald H. Buckley Aug. 1979 24 p refs
(NASA-TP-1525; E-9988) Avail: NTIS HC A02/MF A01 CSCL 07D

Anisotropic friction, deformation, and fracture studies were conducted with /0001/, /10(-1)0/, and /11(-2)0/ silicon carbide surfaces in sliding contact with diamond. The experiments were conducted with loads of 0.1, 0.2, and 0.3 N at a sliding velocity of 3 mm/min in mineral oil or in dry argon at room temperature. The <1010> direction on the basal /0001/ plane exhibits the lowest coefficient of friction and the greatest resistance to abrasion for silicon carbide. Anisotropic friction and deformation of the /0001/, /10(-1)0/, and /11(-2)0/ silicon carbide surfaces are primarily controlled by the slip system /10(-1)0/ <11(-2)0>. The anisotropic fracture during sliding on the basal plane is due to surface cracking along /10(-1)0/ and subsurface cracking along /0001/. The fracture during sliding on the /11(-2)0/ or /10(-1)0/ surfaces is due to surface cracking along /0001/ and /11(-2)0/ or /10(-1)-1 and to subsurface cracking along /10(-1)0/. Author

N79-30381*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LUBRICATING AND WEAR MECHANISMS FOR A HEMISPHERE SLIDING ON POLYIMIDE-BONDED GRAPHITE FLUORIDE FILM
Robert L. Fusaro Aug. 1979 30 p refs
(NASA-TP-1524; E-9965) Avail: NTIS HC A03/MF A01 CSCL 11H

Friction, wear life, rider wear, and film wear for a 440 C high-temperature-stainless-steel, hemispherically tipped rider sliding against polyimide-bonded graphite fluoride films were evaluated in a moist-air atmosphere at 25 C. Optical microscope and surface profilometry observations were made at various sliding intervals to determine how film thickness affected the lubricating and failure mechanisms of the films. Two lubrication regimes operated for the same load. In the first, the film supported the load and the lubricating mechanism consisted of the shear (plastic flow) of a thin layer of the lubricant between the metallic rider and the film surface. In the second, the film did not support the load (it was worn away) and the lubricating mechanism consisted of the shear of very thin lubricant films between flat areas generated on the rider and on sandblasted metallic asperities in the film wear track. Lubricant was supplied from the valleys between the asperities or from the sides of the wear track. With thicker films, wear life increased since a greater lubricant supply was available from the sides of the wear track. Author

N79-30382# Texas A&M Univ., College Station. Dept. of Chemistry.
POLYMERIC ORGANOMETALLICS AS PRECURSORS OF POLYMER SUPPORTED CATALYSTS
David E. Bergbreiter, James M. Killough, and Gregory L. Parsons 15 Apr. 1979 12 p refs
(Contract N00014-77-C-0426)
(AD-A069491; TR-2) Avail: NTIS HC A02/MF A01 CSCL 11/2

This report describes work designed to characterize and systematically explore the chemistry of organometallic derivatives of graphite and polystyrene in order to determine more efficient methods for supported catalyst preparation. The descriptive chemistry of reactive alkali metal-graphite intercalation compounds and in particular the chemistry of potassium-graphite (CBK) is discussed and the results of mechanistic studies of the reducing ability of potassium-graphite are summarized. The preparation of hydrogenation catalysts from potassium-graphite and palladium (II) complexes is reported, although the nature of these catalysts (i.e. intercalated or supported palladium) has not been determined. Catalystic activity of these catalysts in olefin hydrogenation is comparable to palladium on carbon provided that any excess alkali metal-graphite has been quenched. Methods for lithiation of polystyrene have been surveyed and an analytical procedure based on gas chromatography has been devised for analysis of polymeric organolithium species. GRA

N79-30383# Princeton Univ., N. J. Dept. of Chemical Engineering.
PYROLYSIS-MOLECULAR WEIGHT CHROMATOGRAPHY-VAPOR PHASE INFRARED SPECTROPHOTOMETRY AN ON-LINE SYSTEM FOR ANALYSIS OF POLYMERS Progress Report, Apr. 1978 - Apr. 1979
Erdogan Kiran and John K. Gillham May 1979 56 p

(Contract N00014-76-C-0200)
(AD-A069500; TR-16) Avail: NTIS HC A04/MF A01 CSCL 07/3

An instrumental system consisting of a combination of a programmable pyrolyzer, a thermal conductivity detector, a mass chromatograph, a gas chromatograph, a fast-scan vapor-phase infrared spectrophotometer and a computer is discussed and reviewed with examples which show the utility of the system in the analysis of decomposition phenomena in polyolefins, polyolefinsulfones, polymethacrylates, polystyrenes, and polybutadienes. GRA

N79-30384# Texas A&M Univ., College Station. Dept. of Chemistry.
PREPARATION AND CHARACTERIZATION OF ALKALI METAL ORGANOMETALLIC POLYMERS Interim Technical Report
David E. Bergbreiter and James M. Killough 15 Apr. 1979 13 p refs
(Contract N00014-77-C-0426)
(AD-A069513; TR-3) Avail: NTIS HC A02/MF A01 CSCL 11/9

Lithiated cross-linked insoluble polystyrene polymers have been prepared by several different procedures. In the case of organometallic polymers containing alpha-bonded organolithium reagents, chromatographic procedures have been developed which can accurately quantitate the amount of organolithium species present. This analytical procedure employs the reaction of 1,2-dibromodecane with polystyryllithium which generates an amount of 1-decene equal to the amount of polymeric lithium reagent. By analysis of other reaction products such as 1-bromobutane, adsorbed alkyl-lithium reagent can be distinguished from polymeric lithium reagent. GRA

N79-30385# Effects Technology, Inc., Santa Barbara, Calif.
PARTICLE IMPACT DAMAGE IN CERAMICS
William F. Adler and Timothy W. James Mar. 1979 150 p refs
(Contract N00014-76-C-0744)
(AD-A069826; ETI-CR79-623) Avail: NTIS HC A07/MF A01 CSCL 11/2

The objective of this research is to understand and model the deformation and fracture response of materials exposed to water drop collisions. Due to the inherent complexity of the erosive response of materials exposed to a multiple water drop environment, this investigation concentrated on a very idealized water drop impact condition: the normal impact of a spherical water drop on a plane surface. The development of an experimental facility is described for producing spherical water drop impacts on materials at both subsonic and supersonic impact velocities. A reproducible, controlled, and well-characterized impact condition is necessary if an accurate assessment of the material's response is to be established. GRA

N79-30386# Army Armament Research and Development Command, Dover, N. J. Large Caliber Weapon Systems Lab.
EVALUATION OF THE EFFECT OF PROCESSING PARAMETERS ON THE ADHESIVE BONDING OF GLASS-REINFORCED PLASTICS
D. W. Levi, A. T. Devine, W. C. Tanner, R. F. Wegman, M. J. Bodnar, and M. D. Anderson Mar. 1979 41 p refs
(AD-A069706; AD-E400302; ARLCD-TR-78053) Avail: NTIS HC A03/MF A01 CSCL 11/1

Shear strength data for bonds made by adhesively bonding a glass-reinforced plastic (XP-114 epoxy laminate) with three different adhesives (Epon 828/V-140, EC-2214, AF-126) are examined statistically. It is shown that surface exposure time (SET) up to 30 days appears to be immaterial for AF-126 bonds but that shorter SET times give somewhat better bonds in the other cases. Machine sanding leads to better results than hand sanding for the EC-2214 and AF-126 systems. No appreciable difference between hand or machine sanding was discerned for the Epon 828/V-140 system. Only in the case of AF-126 were bond strengths significantly lower after aging 30 days at 120 F (49 C) and 95% RH. These results indicate that the effect of processing parameters on resultant bond strength is highly dependent on the adhesive system used in bonding the glass-reinforced plastic. Methods are described and curves are shown illustrating how smoothed distribution curves of bond strength can be used to observe data overlap and differences. GRA

N79-30387# Los Alamos Scientific Lab., N. Mex.
PROPERTIES OF METALLIC GLASSES CONTAINING ACTINIDE METALS. 1: THERMAL PROPERTIES OF U-M GLASSES (M EQUALS V, Cr, Mn, Fe, Co, AND Ni)
B. C. Giessen and R. O. Elliott 1978 9 p refs Presented at the 3d Conf. on Rapid Quenching, Brighton, Engl., 3 Jul. 1978
(Contract W-7405-eng-36)
(LA-UR-78-1865; Conf-780726-1) Avail: NTIS HC A02/MF A01

The results of a preparative and calorimetric study forming part of a continuing investigation of the actinide glasses are reported. Specifically, lower bounds for the composition limits of glass formation (G.F.) at moderate cooling rates were obtained for the U-M (M = Mn, Fe, Co, Ni) systems and the thermal stabilities of glasses in these four systems as well as for a U-V glass and a U-Cr glass were surveyed. DOE

N79-30388# Brookhaven National Lab., Upton, N. Y.
POLYKETONES AND POLYSULFONES FOR CONSERVATION IN THE ETHYLENE POLYMER INDUSTRY
M. Steinberg, R. Johnson, W. Cordes, and D. Goodman Sep. 1978 12 p refs Presented at the 2d Intern. Meeting on Radiation Processing, Miami, Fla., 22 Oct. 1978
(Contract EY-76-C-02-0016)
(BNL-25625; Conf-7810100-1) Avail: NTIS HC A02/MF A01

A series of ethylene-carbon monoxide copolymers were prepared by chemical catalysis and Co-60 gamma radiation induction, ranging in carbon monoxide content from 41 to 49%. A correlation was established between the method of preparation, the carbon monoxide content of the copolymers, and the mechanical properties of the resulting products. Present evaluations indicate that copolymers containing approximately 50% carbon monoxide prepared by Co-60 gamma induction have significantly improved mechanical properties over copolymers prepared by conventional chemical free-radical catalysis. Based on these results, it is suggested that further experimentation be conducted in radiation-induced copolymerization especially with the use of electron beam machines presently available to industry. DOE

N79-30389# Bendix Corp., Kansas City, Mo.
EFFECT OF VARIOUS GAS MIXTURES ON PLASMA CLEANED CERAMICS Final Report
M. D. Smith Mar. 1979 14 p refs Revised
(Contract EY-76-C-04-0613)
(BDX-613-2107-Rev) Avail: NTIS HC A02/MF A01

The activated gas plasma cleaning efficiencies of various gas mixtures were studied for the preparation of ceramic parts. Differences in the case of removal of organic residue are shown by Auger analyses for the various gases. A reduction in plasma process time is shown to be possible, and gases are compared with oxygen on the basis of cleaning efficiency. The plasma cleaning processes and changes suggested by the work are discussed. DOE

N79-30390# Sandia Labs., Livermore, Calif.
PROPERTIES OF CGW-7806 GLASS
J. E. Shelby and J. Vitko, Jr. Feb. 1979 18 p refs
(Contract EY-76-C-04-9789)
(SAND-79-8600) Avail: NTIS HC A02/MF A01

Optical, physical and chemical properties were measured for CGW-7806 C glass, which has been proposed for use in heliostats. In general, the properties of this glass has not been commercially produced in a low-iron form, research specimens indicate that it can be made with very optical transmission. Chemical solubility measurements indicate satisfactory durability except in very high pH solutions. This behavior is similar to that of float glasses and other potential heliostat glasses. DOE

N79-30391# European Space Agency, Paris (France).
THE INFLUENCE OF THE ENVIRONMENT ON THE ELASTOPLASTIC PROPERTIES OF ADHESIVES IN METAL BONDED JOINTS
Walter Althof, Gerhard Klinger, Gerhard Neumann, and Johanna

Schlothauer Feb. 1979 89 p refs Transl. into ENGLISH of 'Klimaeinfluss auf die Kennwerte des elasto-plastischen Verhaltens von Klebstoffen in Metallklebungen', DFVLR Brunswick Report DLR-FB-77-63, 8 Aug. 1978 Original report in GERMAN previously announced as ESA-90854 Original German report available from DFVLR, Cologne DM 43,40
(ESA-TT-521; DLR-FB-77-63) Avail: NTIS HC A05/MF A01

The shear modulus, the stress at 1% shear-strain, the shear strength, the strain at fracture, and the appertaining shear stress-strain diagrams were analyzed for ten aircraft structural adhesives. These values are calculated from the measured load-deflection behavior of the adhesive in the bond line of lap joints with a thick adherend and a small overlap length, as well as from the torsion pendulum testing of cast adhesives. The measurements are made before and after a long exposure to warmth, cold, moisture, warmth combined with moisture, and changes between cold and combined warmth and moisture. The environmental effects on the adhesion between adherend and adhesives as observed in the tests are described. Author (ESA)

N79-30392# Battelle Inst., Frankfurt am Main (West Germany).
INVESTIGATION OF ELECTRICAL BREAKDOWN AND CONDUCTION PHENOMENA IN SYNTHETIC ULTRAPURE POLYETHYLENES AND THE ELUCIDATION OF THE INFLUENCE OF WELL-DEFINED ADDITIONS AND OF IMPURITIES Final Report
Friedrich Dolezalek, Heinrich Diebig, and Walter Kloepffer Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1977 141 p refs In GERMAN; ENGLISH summary
(Contracts BMFT-ETS-5008; DFVLR-BPT-03-N4-420A)
(BMFT-FB-T-77-90) Avail: NTIS HC A07/MF A01; ZLDI, Munich DM 29,20

The influence of materials parameters such as molecular mass, density, and impurity content (particles and dissolved impurities) on the electrical breakdown of polyethylenes (PE) were elucidated. Further studies involved electrical aging, conduction and polarization processes in PE, and thermal depolarization spectra. The latter method proved to be very sensitive for the assessment of the degree of oxidation in polyethylene and polypropylene. Author (ESA)

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power*, *20 Spacecraft Propulsion and Power*, and *44 Energy Production and Conversion*.

N79-30393 Committee on Science and Technology (U. S. House).
BIOCONVERSION
Washington GPO 1978 409 p refs Hearings before the Subcomm. on Advanced Energy Technologies and Energy Conservation Res., Development and Demonstration of the Comm. on Sci. and Technol., 95th Congr., 2d Sess., 15 Jul. and 5 Aug. 1978
(GPO-37-136) Avail: Subcomm. on Advanced Energy Technologies and Energy Conservation Res., Development and Demonstration

Testimony and statements on issues and prioities surrounding the development of bioconversion (biomass energy conversion) in the different geographical regions of the United States are presented. R.E.S.

N79-30394# Maryland Univ., College Park.
COOPERATIVE EXTENSION SERVICE: ENERGY RESOURCE NOTES
Jul. 1979 12 p refs
Avail: NTIS HC A02/MF A01

The production, potential uses, legislation, availability, and economic feasibility of gasohol in Maryland are addressed. M.M.M.

N79-30395# Naval Weapons Center, China Lake, Calif.
THEORETICAL COMPUTATIONS OF EQUILIBRIUM COMPOSITIONS, THERMODYNAMIC PROPERTIES, AND PERFORMANCE CHARACTERISTICS OF PROPELLANT SYSTEMS Final Report, FY 1978
D. R. Cruise Apr. 1979 104 p refs
(AD-A069832; NWC-TP-6037) Avail: NTIS HC A06/MF A01 CSCL 19/1

This report summarized the methods and equations used in a Naval Weapons Center computer program called the NWC thermochemical program or the propellant evaluation program (PEP). The program is used to calculate high-temperature thermodynamic properties and performance characteristics of propellant systems, and it will handle a maximum of 12 chemical elements and 200 combustion products. Some of the parameters that can be computed with this program are flame temperature, chemical composition, enthalpy, entropy, specific heat ratio and molecular weight of both the combustion chamber and exhaust, frozen and shifting equilibrium, specific impulse, boost velocities, thrust coefficient, characteristic velocity, and exhaust gas velocity. The assumptions made, the limitations imposed, and the input data required for the solution of a specific problem by use of this program are discussed in detail. The appendices provide a working guide for those using the program and give examples of computer inputs. GRA

N79-30396# Chevron Research Co., Richmond, Calif.
CONVERTING GREEN RIVER SHALE OIL TO TRANSPORTATION FUELS
R. F. Sullivan and B. E. Stangeland 1978 41 p refs Presented at the 11th Oil Shale Symp., Golden, Colo., 11 Apr. 1978
(Contract EX-76-C-01-2315)
(CONF-780460-3) Avail: NTIS HC A03/MF A01

Pilot plant data for three processing schemes were generated: hydrotreating followed by hydrocracking, hydrotreating followed by fluid catalytic cracking, and delayed coking followed by hydrotreating. Yields and product inspections are presented for these three cases. DOE

N79-30397# Rocketdyne, Canoga Park, Calif.
HYDROGASIFIER DEVELOPMENT FOR THE HYDRANE PROCESS Annual Report, Mar. 1977 - Feb. 1978
Jun. 1978 273 p refs
(Contract EX-77-C-01-2518)
(FE-2518-17) Avail: NTIS HC A12/MF A01

Work performed on a program to develop a single-stage short-residence-time reactor for flash hydrogasification of coal is described. Experiments involve two different hydrogasifier reactor systems. The first is a bench-scale apparatus with coal feed rates of 2 to 4 lb/hr. Results are reported for a subbituminous coal reacted with hydrogen pressures up to 1600 psig, reactor temperatures ranging from 1475 to 1728 F, and residence times ranging from 300 to 3500 msec. Overall carbon conversions were quite comparable with conversion of lignite observed previously. The second reactor has a nominal coal feed rate of 1/4 ton/hr. Results from tests with subbituminous coal compared well with those from the bench-scale reactor. A computerized numerical model was developed for pulverized coal flow and reaction in an entrained-flow reactor. Formulation and computer programming of the reactor model are described, and some preliminary results from selected 1/4 ton/hour experiments are discussed. DOE

N79-30398# Oak Ridge National Lab., Tenn.
COAL LIQUEFACTION ADVANCED RESEARCH DIGEST
F. M. OHara, Jr. Feb. 1979 51 p refs
(Contract W-7405-eng-26)
(ORNL/FE-2) Avail: NTIS HC A04/MF A01

The solvent refined coal-2 (SRC-2) process, the consol synthetic fuel (CSF) process, and the Fischer-Tropsch synthesis are reviewed. The histories of the chemical processes are traced and present states of knowledge are detailed. The SRC-2 process combines dissolution and hydrogenation to produce hydrocarbon fuels. The CSF process splits dissolution and hydrogenation into two distinct steps and employs indirect hydrogenation. The Fischer-Tropsch synthesis catalytically produces hydrocarbons from carbon monoxide and hydrogen. K.L.

N79-30399# Department of Energy, Washington, D. C. Economic Regulatory Administration.
MOTOR GASOLINE DEREGULATION AND THE GASOLINE

TILT Final Report
Jan. 1979 390 p refs
(DOE/EIS-0039-Vol-1) Avail: NTIS HC A17/MF A01

The environmental impact statement evaluates the environmental impacts, including social and economic impacts, that may result from the exemption of motor gasoline from DOE's mandatory petroleum price and allocation regulations, and the adoption of the gasoline tilt, a proposed regulation that would allow refiners to recover an additional amount of their total increased costs on gasoline. The impacts of the two proposals are considered separately rather than cumulatively. A principal reason for adopting either of these proposals is to eliminate the impediments in current regulations that prevent refiners from recovering, in the prices charged for gasoline, the full amount of costs associated with producing gasoline. Adoption of either proposal may be necessary to encourage increased investments in refining capacity and to prevent shortages of gasoline, particularly unleaded gasoline, after 1980. DOE

N79-30400# Department of Energy, Washington, D. C. Energy Information Administration.
NATIONAL COAL MODEL: COAL SUPPLY CURVES
Sep. 1978 218 p
(DOE/EIA-0103/2) Avail: NTIS HC A10/MF A01

The computerized National Coal Model (NCM) is designed to project future levels of United States coal production, consumption, and prices and to permit the analysis of the impact of coal related public policy issues on such factors. Four major functional components, or modules are integrated: coal supply, electric utility coal demand, nonelectric utility coal demand, and coal transportation. The model has a high degree of resolution and includes 30 supply regions, 35 demand regions, 40 possible coal types, and six consuming sectors. The coal supply component of the NCM is described and the detailed coal supply curves which are its primary output are presented. DOE

N79-30401# Department of Energy, Washington, D. C. Economic Regulatory Administration.
MOTOR GASOLINE DEREGULATION AND THE GASOLINE TILT. VOLUME 2: PUBLIC COMMENTS Final Environmental Impact Statement
Jan. 1979 567 p
(DOE/EIS-0039-Vol-2) Avail: NTIS HC A24/MF A01

The oral comment statement submitted at the December 19, public hearing are contained as well as all the written comments which DOE received on the draft EIS as of the date of publication. Related to the findings in the final EIS is an Analysis Memorandum 1980 Motor Gasoline Supply and Demand, which was prepared by DOE's EIA. Included are the written comments received from the public on the analysis memorandum. DOE

N79-30402# Department of Energy, Washington, D. C. Energy Information Administration.
FACT SHEET: FORECASTED AUTOMOBILE GASOLINE CONSUMPTION
H. Walton and F. Emerson May 1978 11 p refs
(DOE/EIA-0102/1) Avail: NTIS HC A02/MF A01

The impact of the use of alternative assumptions on projected 1985 automobile gasoline consumption is duscussed. The level of 1985 automotive gasoline consumption consistent with meeting EPCA standards under the alternative mileage degradation relationships was found to range between 81.7 and 88.5 billion gallons. DOE

N79-30403# Department of Energy, Washington, D. C. Energy Information Administration.
PETROLEUM SUPPLY/DEMAND ESTIMATES AND COST OF PETROLEUM EXPORTS, 1978-1979
R. Farmer, C. Bwyer, S. Atkinson, and D. Ahl 5 Feb. 1979 29 p
(DOE/EIA-0102/40) Avail: NTIS HC A03/MF A01

Total demand for refined products in 1979 is estimated at between 19.2 and 19.7 million barrels daily, compared with 18.7 million barrels per day in 1978. Demand for motor gasoline in 1979 is expected to be between 7.4 and 7.7 million barrels daily, compared with 7.4 million barrels daily in 1978. To meet the 1979 demand projections, domestic crude production of 8.5 to 8.7 million barrels daily is expected to be supplemented, respectively by 7.4 to 6.9 million barrels of imported crude oil daily. Total petroleum imports (including product) to the 50-State area covered by the DOE imports statistics are expected to average 8.7 to 9.3 million barrels daily in 1979. The cost of petroleum imports to the U.S. balance of payments area, including net imports to U.S. territories such as Puerto Rico and Virgin Islands is expected to be $52 to $55 billion in 1979, (in current dollars). These estimates include over $2 billion for Strategic Petroleum Reserve crude oil purchases. DOE

N79-30404# Department of Energy, Washington, D. C. Energy Information Administration.
EXPECTED IMPACT ON GULF COAST AND MIDWESTERN RESIDUAL FUEL OIL MARKETS OF PROPOSED CHANGES TO THE ENTITLEMENTS PROGRAM AFFECTING THE EAST COAST RESIDUAL FUEL OIL MARKET
M. Taschdjian and R. Konrath Dec. 1978 29 p
(DOE/EIA-0102/42) Avail: NTIS HC A03/MF A01

The impact on Midwestern and Gulf Coast residual fuel oil markets of a proposed rulemaking which would alter the Entitlements Program (Domestic Crude Oil Allocation Program) as it affects the East Coast residual fuel oil market is evaluated. By some measures, shipments of resid from the Gulf Coast to the Midwest actually declined, while other measures show the expected increases. In conjunction with patterns of local production and the trends in interregional and import shipments, the data make it difficult to determine whether the Midwestern region constitutes a separate or related marketing area for residual oil relative to the East Coast and Gulf Coast. Even if the markets are interrelated, however, the impact of the proposed rulemaking on prices and quantities of residual fuel in the Midwest is ambiguous. DOE

N79-30405# Department of Energy, Washington, D. C. Energy Information Administration.
PETROLEUM SUPPLY VULNERABILITY, 1985
G. D. Butler and W. C. Kilgore 8 Jan. 1979 39 p refs
(DOE/EIA-0102/44) Avail: NTIS HC A03/MF A01

Potential U.S. petroleum supply shortfalls are assessed for the year 1985. The potential 1985 shortfalls vary significantly over various scenarios, ranging from 2.6 to 8.5 million barrels per day. The shortfalls increase as the economic growth rate increases. The imposition of an OPEC production capacity constraint diminishes the level of the shortfalls due to the reduced demand growth brought about by increasing world oil prices. Projected OPEC production at constant oil prices is less than the assumed OPEC production capacity. DOE

N79-30406# Department of Energy, Washington, D. C. Energy Information Administration.
OIL AND GAS SUPPLY CURVES FOR THE ADMINISTRATOR'S ANNUAL REPORT
14 Sep. 1978 114 p ref
(DOE/EIA-0103/4; TM/ES/78-17) Avail: NTIS HC A06/MF A01

Regional supply curves are presented for crude oil, natural gas, and natural gas liquids for the years of 1985 and 1990. These curves are generated by DOE's Oil and Gas Model and are part of the database for PIES, a static equilibrium model. The PIES system integrates supply and demand and other factors in energy markets for each region and for several categories of product. The supply projections are based on economic and engineering factors which effect oil and gas supply decisions. The DOE model produces a supply forecast for crude oil, associated-dissolved natural gas, and associated natural gas liquids production which consists of a fifteen year production series based on an assumed new oil price trajectory. The DOE gas model likewise produces a fifteen year production forecast of non-associated natural gas and natural gas liquids based on an assumed trajectory for new natural gas prices. The oil and gas modeling system then combines several oil and gas cases to produce a supply curve for a given year. DOE

N79-30407# Department of Energy, Washington, D. C.
STRATEGIC PETROLEUM RESERVE: EXPANSION OF RESERVE. FINAL SUPPLEMENT TO FINAL ENVIRONMENTAL IMPACT STATEMENT Final Report
Jan. 1979 397 p refs

(DOE/EIS-0034) Avail: NTIS HC A17/MF A01

The environmental impacts of storing one hundred fifty million barrels (MMB) of oil by 1978 and five hundred MMB by 1982 are addressed. The most sensitive parameters appear to be water quality and geology. The adverse impacts that could result from the expanded program include the degradation of surface water quality from construction runoff, increased dredging, and more frequent oil spills. In addition, brine disposal associated with solution mining salt cavities will increase the salinity of the receiving waters, whether underground saline aquifers or small portions of the Gulf of Mexico. Changes in water quality will have a short-term impact on aquatic organisms in local areas. Use of large quantities of ground water for developing salt cavities could cause some surface subsidence over water storage areas, slow salt water encroachment, and movement of near-surface geologic faults. DOE

N79-30408# Institute of Gas Technology, Chicago, Ill.
BEHAVIOR OF GAS DISTRIBUTION EQUIPMENT IN HYDROGEN SERVICE
Jon B. Pangborn, Dale G. Johnson, and Walter J. Jasionowski 1979 16 p refs Presented at 14th World Gas Conf., Toronto, 27 May - 1 Jun. 1979
(Contract EY-76-C-02-2907)
(CONF-790512-2) Avail: NTIS HC A02/MF A01

Prospects for hydrogen delivery in conventional gas distribution systems are addressed. Three model distribution systems were constructed and operated using components loaned or donated by manufacturers and gas utility companies. Specific components for any evident effects of hydrogen exposure are examined. It was experimentally observed that energy delivery as hydrogen could be about 80% that of natural gas under the same operating conditions using a distribution model. Volumetric leakage ratios (hydrogen-to-natural gas) of 2.6:1 to 4.6:1 were measured for various different components in the model systems. DOE

N79-30409# Sandia Labs., Albuquerque, N. Mex.
OPTIMUM FLYER MATERIAL FOR INITIATING DETONATION OF HIGH EXPLOSIVES
J. Michael McGlaun Feb. 1979 33 p refs
(Contract EY-76-C-04-0789)
(SAND-78-1602) Avail: NTIS HC A03/MF A01

Algebraic equations are derived which implicity define shock pressure vs. particle velocity relationship of the optimum material. The form of the initiation criterion studies is shown to be equivalent to several other forms of initiation criteria. Examples show the system may be sensitive to the form of the initiation criterion and the performance of the system may be improved by choosing a flyer material which approximates the optimum. DOE

N79-30410# Department of Energy, Washington, D. C. Office of Building and Community Systems.
PROCEEDINGS OF A SYMPOSIUM ON THE UTILIZATION OF METHANE GENERATED IN LANDFILLS
1978 34 p refs Symp. held at Laurel, Md., 9-10 Mar. 1978
(Grant EM-78-G-01-4206)
(CONF-780340) Avail: NTIS HC A03/MF A01

Past and present experiences in the production of landfill methane in California, New York, and Colorado are summarized. Technical and institutional factors related to the use of landfill methane are identified. The problems identified in implementation included technology transfer, decision-making on the part of local government as to its appropriateness, optimization of recovery, little correlation between laboratory tests and field experiences, design of gas gathering systems, overall landfill design and siting, regulatory restrictions, financing mechanisms, information transfer, and uncertainties on gas ownership and legal liabilities. DOE

N79-30411# Brookhaven National Lab., Upton, N. Y.
BULK HYDROGEN STORAGE: ENGINEERING-SCALE TESTS
M. J. Rosso and G. Strickland 1978 9 p refs
(Contract EY-76-C-02-0016)
(BNL-25264) Avail: NTIS HC A02/MF A01

Two bulk storage engineering problems of hydrogen in the form of metal hydrides are discussed. One problem is caused by the expansion of the alloy as the hydrogen is absorbed. One solution to this problem is to limit the height of the bed by having the hydride inside small diameter tubes. The expanding material can then rise to the free surface. The other problem is related to the inherently poor thermal conductivity in fixed beds of fine particles. A program to improve the bed's thermal conductivity by small amounts of high conductivity materials can solve this problem. DOE

N79-30412# Salzgitter A.G. (West Germany).
METHANE AND METHANOL AS ALTERNATIVE ENERGY SOURCES: A COMPARATIVE PROFITABILITY STUDY Final Report
Heinrich Deipenau Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1978 357 p refs In GERMAN; ENGLISH summary
(Contract BMFT-ETS-3057-A)
(BMFT-FB-77-84) Avail: NTIS HC A16/MF A01; ZLDI, Munich DM 74,35

Elaborations of the economic and technical ways and means for the supply of LNG and methanol to industrial centers, using natural gas from the Iranian area as raw material, were compared. The classification of given possibilities for the preparation, transportation, and storage of potential sources of energy is discussed. Cost estimates of transportation, a comparative examination of economic and technical aspects, and a description of the use of LNG and methanol in Germany (motor cars, power plants, gas supply) are presented. It is concluded that energy costs for LNG in Wilhelmshaven are lower than those for methanol, and that large quantities of LNG and methanol from the Persian Gulf can be sold in the various sectors of the German energy market on the condition that crude gas prices on the Persian Gulf do not exceed 3-DM/Gcal. Author (ESA)

N79-30413# National Technical Information Service, Springfield, Va.
HYDROGEN STORAGE, PART 1. STORAGE AS A GAS OR LIQUID. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1974 - May 1979
Diane M. Cavagnaro Jun. 1979 135 p
(NTIS/PS-79/0581) Avail: NTIS HC $28.00/MF $28.00 CSCL 21D

This bibliography references aspects of storing hydrogen fuels as a liquid or gas. Topics covered include fuel storage, energy storage, and the construction of storage tanks. Batteries, fuel cells, and solar cells, if related to hydrogen storage, are also mentioned. GRA

N79-30414# National Technical Information Service, Springfield, Va.
HYDROGEN STORAGE, PART 2. HYDROGEN AS HYDRIDE. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1974 - May 1979
Diane M. Cavagnaro Jun. 1979 130 p
(NTIS/PS-79/0582) Avail: NTIS HC $28.00/MF $28.00 CSCL 21D

This bibliography covers hydrogen storage as a hydride. Citations discuss the chemical and physical properties of the hydride and its usefulness for hydrogen storage. References also cover the conversion of hydrogen to a hydride and the conversion back to hydrogen. This updated bibliography contains 121 abstracts, 14 of which are new to the previous edition. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N79-30415*# Boeing Engineering and Construction, Seattle, Wash.
MOD-2 FAILURE MODE AND EFFECTS ANALYSIS
Robert Lynette and Robert Poore Jul. 1979 302 p Sponsored by NASA
(Contract DEN3-2; DE-AI01-79ET20485)
(NASA-CR-159632) Avail: NTIS HC A14/MF A01 CSCL 13L

The results of a failure mode and effects analysis of the Mod-2 wind turbine are presented. Author

N79-30416# Los Alamos Scientific Lab., N. Mex.
OPTICAL MEASUREMENTS ON HYDROGEN AT ULTRA-HIGH STATIC PRESSURES
R. L. Mills and D. H. Liebenberg Feb. 1979 19 p refs
(Contract W-7405-eng-36)
(LA-7692-MS) Avail: NTIS HC A02/MF A01

The development of apparatus and techniques for studying hydrogen and other gases under ultrahigh static pressure in diamond-anvil cells are described. A facility was established in which precision optical measurements can be made; special diamond cells for use at low temperatures were built; procedures were devised for loading cells with gases at high density; and preliminary visual, X-ray, and spectral studies on various gases at pressures up to 50 kbar were conducted. DOE

N79-30417# Bayerische Akademie der Wissenschaften, Munich (West Germany).
NUMERICAL METHODS FOR APPROXIMATING AND REPRESENTING THE GEOMETRICAL SYSTEMS USED IN WIDE SPAN PLANE LOAD BEARING STRUCTURES Ph.D. Thesis- Stuttgart Univ. [MATHEMATISCH-NUMERISCHE METHODEN ZUR APPROXIMATION UND ABBILDUNG DER SYSTEMGEOMETRIE WEITGESPANNTER FLAECHEN-TRAGWERKE]
Dieter Schwenkel Deut. Geodaetische Univ. 1978 101 p refs In GERMAN
(Ser-C/Diss-243; ISBN-3-7696-9298-5) Avail: NTIS HC A06/MF A01

The construction of the 1972 Olympia stadium in Munich prompted more rigorous studies of this type of construction. Mathematical representations of fixed curved surfaces are discussed. Mathematical models of surfaces are transposed so as to permit a finite difference treatment. Minimum surface areas are sought; a smoothing procedure is developed that can be applied to surfaces of any shape. Interpolation possibilities with elementary triangular surface elements are analyzed. surface shapes are determined in relation to relevant parameters. Some applications are presented as examples. Author (ESA)

N79-30418# National Technical Information Service, Springfield, Va.
METRICATION IN THE UNITED STATES. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Mar. 1979
Guy E. Habercom, Jr. Apr. 1979 186 p Supersedes NTIS/PS-78/0316, NTIS/PS-77/0268, NTIS/PS-76/0305 and NTIS/PS-75/123
(NTIS/PS-79/0359/4; NTIS/PS-78/0316; NTIS/PS-77/0268; NTIS/PS-76/0305; NTIS/PS-75/123) Avail: NTIS HC $28.00/MF $28.00 CSCL 14B

Materials are cited on the metric system of measurements and conversion of U.S. measurements to the metric system. The reports deal with the metrication process, industrial and economic impacts, problems involved, the benefits anticipated, and public reactions and relations. The metric system is discussed, along with its application to various fields. (This updated bibliography contains 179 abstracts, 17 of which are new entries to the previous edition.) GRA

N79-30419# National Bureau of Standards, Washington, D. C. National Measurement Lab.
SPECIFICATIONS AND TOLERANCES FOR REFERENCE STANDARDS AND FIELD STANDARD WEIGHTS AND MEASURES. 3: SPECIFICATIONS AND TOLERANCES FOR GRADUATED NECK TYPE VOLUMETRIC FIELD STANDARDS
Blayne C. Keysar Mar. 1979 25 p refs Supersedes COM-71-50259
(PB-294577/2; NBS-HB-105-3; COM-71-50259) Avail: NTIS HC A02/MF A01 CSCL 14B

These specifications and tolerances are recommended as minimum requirements for standards used in the field by State and local weights and measures officials and others in quantity determinations of liquid commodities. DOE

N79-30420# California Univ., Richmond. Earthquake Engineering Research Center.
OPTIMAL DESIGN OF AN EARTHQUAKE ISOLATION SYSTEM
M. A. Bhatti, K. S. Pister, and E. Polak Oct. 1978 120 p refs
(Grant NSF ENV-76-04264)
(PB-294735/6; UCB/EERC-78/22; NSF/RA-780544) Avail: NTIS HC A06/MF A01 CSCL 13L

Optimal design of an earthquake isolation system, consisting of natural rubber bearings and special nonlinear energy absorbing devices, is presented. An algorithm for efficient analysis of structural response, based upon the Newmark and Runge-Kutta methods with optional Newton-Raphson iteration is given. The optimal design problem, incorporating this simulation algorithm, is formulated as a mathematical programming problem with time dependent constraints and is solved using a feasible directions algorithm. Several numerical examples are presented, in which it is demonstrated that a properly designed isolation system can substantially reduce structural damage for a class of potential earthquakes. GRA

N79-30421# National Bureau of Standards, Washington, D. C.
METROLOGY IN INDUSTRY AND GOVERNMENT: HOW TO FIND OUT WHO NEEDS WHAT SERVICES
H. Steffen Peiser, ed., Raymond C. Sangster, ed., and Wun Jung, ed. (Korea Standards Res. Inst., Dae Jeon) Apr. 1979 173 p refs Sponsored in cooperation with Agency for Intern. Develop., Washington, D. C.
(PB-294364/5; NBS-SP-539; LC-79-600040) Avail: NTIS HC A08/MF A01 CSCL 14B

A regional seminar sponsored by the Korea Standard Research Institute, the National Bureau of Standards, and the U.S. Agency for International Development was held at the new K-SRI Laboratories at Daeduk near Dae Jeon in the Republic of Korea on September 27-28, 1978. The participants representing most of the countries in the South Asian and Western Pacific Region discussed the importance of providing services in measurement science and technology (metrology) to governmental and industrial organizations in the region. The consensus was that a need for a central national capability in metrology existed in countries at all levels of development, and that central organization could be a focal point for intra- and international cooperation, which alone could lead to compatibility of measurements, a prerequisite for quality control for all kinds of products in domestic and international markets. Australia and New Zealand had established a group of accredited test laboratories to disseminate the accuracies inherent in the national measurement system. Industry was increasingly aware that metrology was essential to development, but the specific needs at appropriate accuracies needed to be established by surveys. The Korean Government strongly supported the establishment of metrological services as is well illustrated by the new K-SRI laboratories. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N79-30422*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TECHNICAL ASSISTANCE FOR LAW-ENFORCEMENT COMMUNICATIONS: CASE STUDY REPORT
Norman B. Reilly and James A. Mustain 15 Jun. 1979 21 p refs Sponsored in part by Law Enforcement Assistance Admin.
(Contract NAS7-100)
(NASA-CR-162108; JPL-Pub-79-71; Rept-1) Avail: NTIS HC A02/MF A01 CSCL 17B

Methods developed to improve police communications systems are described. Use of queueing analysis shows several ways of improving time of response to inquiries made from the field for license plate checks and for information on current wants and warrants, through a state multiple switcher network. Design criteria for more efficient centralized switching equipment

are developed. A message load problem experienced in a dispatch center is analyzed, showing that communications could be improved by adding communications channels, not by adding people. K.L.

N79-30423*# Hughes Aircraft Co., Culver City, Calif. Radar Microwave Lab.
X-BAND SLOTTED ARRAY TEST PANEL AND TEST FIXTURE Final Report
Aug. 1979 163 p
(Contract NAS9-15611)
(NASA-CR-160300; FR-79-27-1014) Avail: NTIS HC A08/MF A01 CSCL 17I

Data from the development of the X-band slotted array test band, X-band array test fixture, and the X/L-band test fixture for the Support Instrumentation Requirements program are documented. An X-band array was built and installed with an existing L-band module in such a way as to permit antenna pattern measurements in a series of nonplanar configurations that might simulate the thermal effects of nonuniform solar illumination on the array in a space environment. This was accomplished with eight X-band subpanels mounted adjacently on individually adjusted supports which were then co-mounted to a larger frame which served to mount and physically distort the existing L-band module. The L-band module is a heavy electrical breadboard array section that was fabricated to demonstrate the performance capabilities of a slotted waveguide array at L-band frequencies. Drawings, mechanical analysis, and descriptions of test configurations are presented. K.L.

N79-30424*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Electrical Engineering.
A DEPOLARIZATION AND ATTENUATION EXPERIMENT USING THE COMSTAR AND CTS SATELLITES Final Report
C. W. Bostian, S. M. Babula, J. R. Dent, R. E. Dombroski, S. O. Lane, E. A. Manus, R. E. Marshall, D. N. Meadows, W. L. Stutzman, and P. H. Wiley 9 Feb. 1979 54 p
(Contract NAS5-22577)
(NASA-CR-159939; Rept-1979-1) Avail: NTIS HC A04/MF A01 CSCL 20N

Monthly and annual percent-of-time data on ground rain fall rate and attenuation on satellite downlinks at 11.7 GHz, 19.04 GHz, and 28.56 GHz is presented. Equal probability values of attenuation and rain rate are compared for monthly, quarterly, half-year periods and for the entire year. Regression equations relating cross polarization isolation to the logarithm of attenuation are also presented. R.E.S.

N79-30425 Committee on Commerce, Science, and Transportation (U. S. Senate).
RADIO FREQUENCY INTERFERENCE
Washington GPO 1978 135 p refs Hearing on S. 864 before the Subcomm. on Communications of the Comm. on Commerce, Sci., and Transportation, 95th Congr., 2d Sess., 14 Jun. 1978
(GPO-31-144) Avail: Subcomm. on Communications

Testimony was given and arguments were heard to ammend the communications act of 1934 to authorize the Federal Communications Commission to prescribe regulations with respect to certain electronic equipment that is susceptible to radio frequency energy interference. M.M.M.

N79-30426# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Electrical Engineering.
A MILLIMETER WAVE ATTENUATION AND DEPOLARIZATION EXPERIMENT USING COMSTAR AND CTS SATELLITES Final Report, 1 May 1977 - 30 Oct. 1978
W. L. Stutzman and Charles W. Bostian 30 Oct. 1978 55 p refs
(Grant DAAG29-77-G-0083; Proj. P14066-EL)
(NASA-CR-159934; SATCOM-79-2) Avail: NTIS HC A04/MF A01 CSCL 20N

The nonuniform character of rain is included in a millimeter wave attentuation model in a way that facilitates prediction for various elevation angles and frequencies. Attenuation data from several experiments are presented in support of the model and scaling of attenuation values from one frequency to another is discussed. The synthetic storm together with the Rice-Holmberg rain rate equation is used to predict attenuation statistics from rainfall accumulation data. In addition, propagation medium characteristics leading to nonreciprocal behavior and the signal parameters affected by this behavior are discussed. Examples for millimeter wave signals passing through rain are presented together with numerical results. K.L.

N79-30427*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Electrical Engineering.
CTS 11.7 GHz ISOLATION DATA FOR THE CALENDAR YEAR 1978 Interim Report
C. W. Bostian and J. R. Dent 4 May 1979 37 p refs
(Contract NAS5-22577)
(NASA-CR-159935; Rept-1979-3) Avail: NTIS HC A03/MF A01 CSCL 20N

Monthly and annual percent-of-time data on polarization isolation measured for the CTS spacecraft 11.7 GHz downlink are presented. The relationship between isolation and attenuation and the degree to which isolation can be predicted from attenuation data are discussed. K.L.

N79-30428*# Public Service Satellite Consortium, San Diego, Calif.
THE VALUE OF IMPROVED TELECOMMUNICATIONS SERVICE TO HOSPITALS: A PRELIMINARY ASSESSMENT
James G. Potter 30 Apr. 1979 110 p refs
(Contract NAS5-23865)
(NASA-CR-159940) Avail: NTIS HC A06/MF A01 CSCL 17B

In view of the rapid rate of development of domestic telecommunication services and the emphasis on private networks, it was sought to determine if hospitals had major requirements which could be aggregated and served by such networks. The value of the information transfer services judged to be most promising over the next twenty years was evaluated, based on expenditures and activity levels in five hospitals and one management services firm and the judgement of their senior staff. An implicit assumption is that services will become affordable once the hospital industry aggregates its requirements. A methodology to evaluate the value of telecommunication services in a hospital was developed and tested. G.Y.

N79-30429*# Edutel Communications and Development, Inc., Palo Alto, Calif.
PUBLIC SERVICE USER TERMINUS STUDY COMPENDIUM OF TERMINUS EQUIPMENT
1 May 1979 259 p
(Contract NAS5-25403)
(NASA-CR-159941) Avail: NTIS HC A12/MF A01 CSCL 17B

General descriptions and specifictions are given for equipments which facilitate satellite and terrestrial communications delivery by acting as interfaces between a human, mechanical, or electrical information generator (or source) and the communication system. Manufactures and suppliers are given as well as the purchase, service, or lease costs of various products listed under the following cateories: voice/telephony/facsimile equipment; data/graphies terminals; full motion and processes video equipment; and multiple access equipment. A.R.H.

N79-30430# Georgia Inst. of Tech., Atlanta.
PRELIMINARY DESIGN STUDY FOR A COMMAND-GUIDED BALLISTIC MISSILE RADAR
G. W. Ewell and E. K. Reedy Redstone Arsenal, Ala. Army Missile Research and Development Command 18 Oct. 1978 71 p refs
(Contract DAAG29-76-D-0100; DA Proj. 1T1-61101-A-91A)
(AD-A068632; DRDMI-T-CR-78-30) Avail: NTIS HC A04/MF A01 CSCL 17/1

The US Army continues to develop essentially free-flight or ballistics rockets for providing counterbattery and area fire. The free-flight rocket can deliver high volumes of TOT fire for the destruction of high-value time sensitive, area-type targets. If a relatively inexpensive guidance and control package could be integrated into the free-flight rocket such that the accuracy of these missiles was increased to the 2.0-2.5 mil range, their

effectiveness against hard point targets could be significantly increased. Such a high-accuracy, command-guided ballistic rocket could replace some general and direct support roles calling for munitions to be delivered on targets with high precision and destructiveness and roles where augumentation fires are delivered in close support of maneuver elements. GRA

N79-30431# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
IFM RECEIVER TEST AND EVALUATION Interim Report, May - Nov. 1978
Rudy L. Shaw and J. B. Y. Tsui Apr. 1979 54 p refs
(AF Proj. 7633)
(AD-A069873; AFAL-TR-79-1049) Avail: NTIS HC A04/MF A01 CSCL 17/4

The Instantaneous Frequency Receiver (IFM) is a lightweight, low cost receiver which has potential for use in Electronic Warfare Systems. It is also susceptible to erroneous frequency reporting when presented with simultaneous signals. This report summarizes work done with the IFM receiver to statistically characterize the simultaneous signal problem areas and proposes possible methods of mitigating these problems. GRA

N79-30432# University Coll., London (England). Dept. of Statistics and Computer Science.
UNIVERSITY COLLEGE LONDON INDRA PROJECT Quarterly Status Report, 1 Jul. - 30 Sep. 1978
Peter T. Kirstein Mar. 1979 8 p refs
(Grant N00014-77-G-0005)
(AD-A069862; TR-55; QSR-17) Avail: NTIS HC A02/MF A01 CSCL 17/2

This quarter saw the first major change on our ARPANET-EPSS-RL convention in several years, with the introduction of a completely new release of the PDP-9 operating system. The SATNET activity came to a very rewarding finale. We were able to make a number of interesting User Level Experiments, using tools which had been developed in previous years. Most of Internetwork activity during the quarter was in paper studies. Of particular importance was the study of how best to provide Transnet File Transfer Facilities, and a study of the X.25 CCITT protocol. The simulation work produced two publications. The first was a study of Hop-to-Hop versus end-to-end acknowledgement; the second constrasted the case of positive and negative acknowledgement. GRA

N79-30433# Resource Engineering and Planning Co., Huntsville, Ala.
RADIATED FIELD SUSCEPTIBILITY TASKS Final Report, 30 Sep. 1975 - 24 Jun. 1977
Glenn L. Brown 24 Jun. 1977 28 p
(Contract DAAH01-76-C-0236)
(AD-A069735; REAP-FR-0236) Avail: NTIS HC A03/MF A01 CSCL 14/2

Problems associated with the generation of valid test environments at the electromagnetic effects test facilities of the U.S. Army Missile Command are identified and methods of improvement described. Equipment and procedures for measuring the spatial characteristics and intensity of test fields are described. Recommendations for improvements in facilities and susceptibility assessment methodology which will effect a significant decrease in the time and cost of susceptibility programs are presented. GRA

N79-30434# Harvard Univ., Cambridge, Mass. Applied Sciences Div.
SCATTERING FROM OBSTACLES OVER THE EARTH Interim Report
R. W. P. King, H. M. Lee, and L. C. Shen Griffiss AFB, N. Y. RADC Apr. 1979 54 p refs
(Contract F19628-77-C-0146; AF Proj. 2305)
(AD-A069644; RADC-TR-79-71; SR-1) Avail: NTIS HC A04/MF A01 CSCL 17/9

In Part I of this report the experimental setup and techniques for measuring the fields scattered from a metal circular loop and a straight wire placed above the ground are described. Measured scattered fields (E squared) are presented as functions of loop size, the height of the loop above the ground, and the location of the receiving antenna. The frequency used was 1.5 GHz. Resonant and nonresonant loops and a straight wire a half wavelength long were used. The experiments were performed on an open ground with the scatterer placed less than a third of a wavelength above the ground. A theoretical treatment of the scattering from horizontal-wire antennas over the earth is presented in Part II. The well-known electromagnetic fields generated by infinitesimal dipoles in the presence of the earth are reviewed briefly. The fields due to currents in extended conductors can be expressed in terms of an integral over the occupied volume, but its evaluation is possible only when the currents are known in their dependence on the properties of the earth. This is true of the horizontal-wire antenna quite close to the earth, both when driven by a localized emf and when acting as a scatterer in an incident field. Expressions for the most useful component of the radiated or scattered field are formulated for an end-driven Beverage-type antenna and the horizontal-wire as a scatterer in the presence of the earth. GRA

N79-30435# Rockwell International Corp., Cedar Rapids, Iowa. Telecommunications Products Div.
THE 156W TRANSCEIVER MULTICOUPLERS Annual Report, 1 Oct. 1977 - 30 Sep. 1978
G. Snider Feb. 1979 36 p
(Contract DAAB07-77-C-0193)
(AD-A069520; CORADCOM-77-0193-5; Rept-523-0769373-00121D) Avail: NTIS HC A03/MF A01 CSCL 09/5

This report describes the activity during the first annual report period of Contract DAAB07-77-C-0193. The frequency ranges of a 2-channel and a 5-channel vhf multicoupler developed under a previous contract are extended. In adddition, a 'dummy' filter designed to replace an unused channel is described. Design parameters and test data are presented. GRA

N79-30436# Illinois Univ. at Urbana-Champaign. Coordinated Science Lab.
ON OPTIMUM DATA QUANTIZATION FOR SIGNAL DETECTION M.S. Thesis
Dimitrios Alexandrou Sep. 1978 66 p refs
(Contract DAAB07-72-C-0259)
(AD-A069780; R-827; UILU-ENG-78-2220) Avail: NTIS HC A04/MF A01 CSCL 09/3

An introduction to quantization and to several important detection problems is given in the initial sections. A detailed review follows of most of the work done on quantization for detection. The equivalence of the criterion of minimum mean-squared error between quantized data and data transformed by the locally optimum nonlinearity and the one of maximum efficacy is shown for the general case of local decisions based on independent samples. In addition, a sufficient condition for optimum detection is derived for the above case. Finally, numerical results are obtained for the locally-optimum quantizer for the case of detecting stochastic signals in generalized Gaussian noise. GRA

N79-30437# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
MICROWAVE EFFECTIVE EARTH RADIUS FACTOR VARIABILITY AT WIESBADEN AND BALBOA
Roberto Rubio and Don Hoock Feb. 1979 32 p refs
(DA Proj. 1L1-62111-AH-71)
(AD-A069610; ERADCOM/ASL-TR-0023) Avail: NTIS HC A03/MF A01 CSCL 20/4

This report describes the variability of the microwave (3 to 30 GHz) circuit design parameter, effective earth radius factor, at two sites which served as test cases: Balboa, Panama, and Wiesbaden, Germany. Median effective earth radius factors, K, derived from meteorological data for the first 100 m altitude at these two sites, were 1.32 for Wiesbaden and 1.68 for Balboa. Median K factors for 84 other world localities are included in table 1. Numerous medians differ considerably from the K = 4/3 standard. K factor variability at Balboa and Wiesbaden is illustrated with sets of equivalent earth profile curves enclosing 68.3, 95.4, 99.7, and 100 percent of the data and by K factor cumulative distribution functions bounded by respective 90 and 99 percent confidence limits. Effective earth radius factors were highly variable, particularly at Balboa, where the meteorological variability is high within the first 100 m altitude. GRA

N79-30438# Naval Research Lab., Washington, D. C.
STABLE MESA ANTENNA PATTERNS
William R. King 18 May 1979 43 p refs
(Contract N00014-78-C-0681; RR0210541)
(AD-A069484; NRL-MR-3998) Avail: NTIS HC A03/MF A01 CSCL 09/5

The maximum entropy spectral analysis (MESA) technique is examined for use in computing spatial antenna patterns. The problem of split peaks is investigated, and five possible stabilization methods are examined. MESA is applied to data simulated for an 8 element antenna linear array. Split peaks are attributed to interference of noise peaks located in the vicinity of the incident signal. The split peak problem is alleviated with use of the proposed stabilization methods. Results of the investigation indicate that two of the examined averaging techniques provide excellent stabilization for MESA. Antenna patterns, computed with MESA and either of the two averaging methods, contain nearly white noise and substantially enhanced SNR. GRA

N79-30439# Cubic Corp., San Diego, Calif. Defense Systems Div.
METRRA SIGNATURE: RADAR CROSS SECTION MEASUREMENTS. INSTRUCTION MANUAL Final Report
D. A. Dauben and D. Hull Dec. 1978 88 p
(Contract DAAK70-77-C-0189)
(AD-A069598) Avail: NTIS HC A05/MF A01 CSCL 17/9

The acronym METRRA represents 'Metal R-Radiating Radar'. The METRRA signature tests result from a third harmonic system, since the receive frequency is three times that of the transmit frequency. Of particular significance is METRRA's inherent ability to penetrate foliage. Conventional radar systems provide returns from undesired targets such as trees, water, dense foliage, etc., while the METRRA system does not. The METRRA process is responsive only to man made non linear junctions. Non linear junctions, when radiated by high power RF energy, convert the energy to harmonic frequencies and re-radiating radar. GRA

N79-30440# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
AN EVALUATION AND COMPARISON OF SEVERAL MEASURES OF IMAGE QUALITY FOR TELEVISION DISPLAYS Ph.D. Thesis - Arizona Univ.
Harry Lee Task Jan. 1979 153 p refs
(AF Proj. 7184)
(AD-A069690; AMRL-TR-79-7) Avail: NTIS HC A08/MF A01 CSCL 14/5

Television display systems are currently widely used for many image transmission applications other than home entertainment. For many military and commercial uses the quality of the displayed imagery is critical with respect to its effect on observer performance. This dissertation investigates 19 figures of merit (FOM's) that have been proposed as measures of television image quality. Target detection and target recognition study was implemented to determine which of the 19 FOM's correlated highest with performance. The study employed a 525 line, 60 Hz field rate television display system with 2:1 interlace of fields. Nine different display quality conditions were investigated using all combinations of three contrast ratios (50:1, 50:5 and 50:15) and three video bandwidths (6.0 MHz, 1.0 MHz, and 0.4 MHz). Noise was not varied. Three FOM's stood out as promising indicators of display quality and observer performance. The highest correlating FOM was the log band-limited modulation transfer function area (log BLMTFA) closely followed by the just-noticeable difference area-log (JNDA-log), 1/2 cpd and the JNDA-log. GRA

N79-30441# Sandia Labs., Albuquerque, N. Mex.
PROPAGATION OF PLANE WAVES IN GRANULAR MEDIA
Jace W. Nunziato 1978 10 p refs Presented at Symp. on Continum Mechanical and Statistical Approaches in the Mechanics of Granular Materials, Sendai, Japan, 5 Jun. 1978
(Contract EY-76-C-04-0789)
(CONF-780618-1) Avail: NTIS HC A02/MF A01

Using a one-dimensional formulation of the continuum theory of granular materials, the longitudinal response of two classes of materials was modeled. The two classes are materials with compressible granules, such as pressed powders and sands at high confining pressures, and flowing materials with incompressible granules, such as sands at low confining pressures. The speed and the amplitude of the various types of acceleration waves possible in each class were considered. In materials with compressible granules, two waves were found to exist, an elastic wave followed by a compaction wave. However, in flowing materials with incompressible granules, the only wave possible was a wave of dilatancy. DOE

N79-30442# Fondazione Ugo Bordoni, Rome (Italy).
RESEARCH PROGRAM ON ATMOSPHERIC CONDITIONS INFLUENCE ON RADIOWAVE PROPAGATION AT FREQUENCIES OVER 10 GHz: PROGRESS REPORT AND FIRST CONCLUSIONS [PROGRAMMA DI RICERCA SULLA INFLUENZA DELLE CONDIZIONI ATMOSFERICHE SULLA RADIOPROPAGAZIONE A FREQUENZE SUPERIORI A 10 GHz: STATO DI AVANZAMENTO E PRIME CONCLUSIONI]
Francesco Fedi Mar. 1977 39 p refs In ITALIAN
(FUB-23-1977) Avail: NTIS HC A03/MF A01

Information on the role of rainfall in atmospheric attenuation of radiowaves at frequencies higher than 10 GHz was collected in order to precisely define the phenomenon. Statistics were compiled on attenuation as a function of instantaneous rainfall intensity values on given sets of other parameters. Data collected over a seven year period was systematically elaborated and initial results indicate that one more year of measurements are sufficient for the formulation of a practical rainfall attenuation definition as well as for identifying those areas where work needs to be done. Author (ESA)

N79-30443# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Flugfunk und Mikrowellen.
CALCULATION OF HETERODYNE-DETECTION WITH FOCUSED RADIATION
Friedrich Malota Sep. 1978 27 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-552)
(DLR-FB-78-20) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 11,30

The advantages in the application of heterodyne-detection with focused radiation are described. Several possibilities for detection are explained and the signal to noise ratios are computed using a basis the three-dimensional formulation of the focus region (Lommelfunction). The dependence of the signal to noise ratio on the distance between the detector and the focal plane is investigated in detail. The results and the limitations of the computational methods are discussed. Author (ESA)

N79-30444# Instituto Nacional de Tecnica Aeroespacial, Esteban Terradas, Torrejon de Ardoz (Spain).
AN EXPERIMENTAL INVESTIGATION INTO LOW GAIN TT AND C S BAND ANTENNAS Final Report
J. Torres, F. Vila, F. Mata, and M. Peralta Paris ESA Dec. 1978 226 p refs
(Contract ESTEC-3304/78/NL-AK(SC))
(INTA-SB/AE/216/FR; ESA-CR(P)-1167) Avail: NTIS HC A11/MF A01

Two breadboard models of cardioid coverage TT and C antennas were analyzed and tested in order to improve their electrical performances. These antennas were tested both when isolated and when mounted on a spacecraft mock-up. Results obtained based on specification requirements are compared with a reference antenna. Of the two configurations examined (antenna A, with skirt, giving 120 deg half-angle coverage and antenna B, without skirt, giving approximately 140 deg coverage), both showed improvement. A modified coupler intended to improve the feeding network was also added to the system. Mathematical modeling is described and good agreement between theoretical and experimental results is shown. Author (ESA)

N79-30445# Siemens A.G., Munich (West Germany). Fachgebiet Weitverkehrstechnik.
RF-SENSOR-SYSTEM USING A SATELLITE BROADCAST ANTENNA Final Report
Heinrich Bruentrup, Ulrich Scherner, Gerhard Schindler, Bernhard Spicker, and Werner Vallentin Bonn Bundesmin. fuer Forsch.

u. Technol. Dec. 1977 132 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-590)
(Contracts BMFT-WRT-5007; DFVLR-BPT-01-EO-804)
(BMFT-FB-W-77-35) Avail: NTIS HC A07/MF A01; ZLDI, Munich DM 27,30

The feasibility of a Beam Pointing Error Indicating System which does not derive its beam pointing error information from the position of the antenna beam center with reference to the coverage area center, but from the optimal illumination of the coverage edge was investigated. Characteristic components of the system are several beacon stations (grounds segment), a sensor receiving device, and a reference antenna (space segment). Beacon frequency is within the frequency range 12.5 to 12.75 GHz. The sensor receiving device includes an RF-switch (signal comparator), a receiver, a demodulator, and an evaluation circuit for processing beacon signal information. Results shown that with the selected operating mode (regional time division multiplex) an accuracy of better than 0.01 deg is achieved.
Author (ESA)

N79-30446# Institute for Telecommunication Sciences, Boulder, Colo.
AN ADDITIONAL CATALOG OF PROGRAMS AND DATA FOR 100 MHz - 100 GHz RADIO SYSTEM PREDICTIONS
Jack T. Collins and F. K. Steele Jan. 1979 43 p
(PB-293366/1; NTIA/Rept-79/15) Avail: NTIS HC A03/MF A01 CSCL 20N

Analysis aids and data bases for predicting the performance of 100 MHz - 100 GHz communication systems are presented and briefly described. They are loosely grouped into the following functional categories: (1) computations of transmission loss and radar returned power; (2) computations of desired to undesired signal ratios; (3) computations of atmospheric and precipitation parameters; (4) data bases and associated programs; (5) performance of digital communication systems; and (6) miscellaneous programs. Sources are given for the analysis aids, data bases, and additional information. GRA

N79-30447# Institute for Telecommunication Sciences, Boulder, Colo.
RECEIVED SIGNAL LEVEL (RSL) MEASUREMENT AND ANALYSIS WITH A DESK-TOP COMPUTER
D. R. Wortendyke and T. H. Hildebrandt Feb. 1979 155 p refs Sponsored in part by AF and Army
(PB-294820/6; NTIA/Rept-79/17) Avail: NTIS HC A08/MF A01 CSCL 14B

A software package was developed which automatically measures and analyzes received signal level of four microwave communication receivers. An initial manual calibration directed by the program is stored on a data tape cartridge. The software uses the IEEE 488-1975 bus to run the test unattended for one month. Data are sampled on each receiver four times per second with a typical resolution of 3 dB over a 60-dB dynamic range. In addition to an analysis each hour during the test, programs may be run after the test to list and plot cumulative distributions and hourly medians on a peripheral graphic plotter. The graphs are drawn and annotated completely under software control. GRA

N79-30448# Systech Corp., Severna Park, Md.
EMS COMMUNICATIONS COMPATIBILITY STUDY Final Report, Oct. 1977 - Sep. 1978
Sandra Archambault and Frank Pethel Nov. 1978 63 p refs (Contract DOT-HS-7-01818)
(PB-293365/3; DOT-HS-803-858) Avail: NTIS HC A04/MF A01 CSCL 17B

Design standards and recommendations for the implementation of compatible, effective communications systems for emergency medical services (EMS) using the UHF frequencies allocated by the FCC are provided. Five major task areas were studied which involved visiting seven major operational EMS communications systems, formulating design standards, investigating disaster situations, studying the interoperation of EMS with other public safety services, and studying the possible use of innovative communications concepts in EMS systems. The potentially severe problems that are likely to develop as UHF EMS systems become more widespread are indicated and design standards that could be employed to prevent these problems are given. GRA

N79-30449# Federal Communications Commission, Washington, D. C. Research and Standards Div.
FCC PARTICIPATION IN THE JOINT US-CANADIAN COMMUNICATIONS TECHNOLOGY SATELLITE EXPERIMENT
Irma B. Galane Feb. 1979 233 p refs
(PB-293288/7; FCC/OCE/RS79-02) Avail: NTIS HC A11/MF A01 CSCL 17B

The Federal Communications Commission is actively participating in joint United States-Canadian Communications Technology Satellite (CTS-Canadian 'Hermes') experimentation to evaluate the potential use of small, relatively simple, inexpensive earth receiving terminals for satellite broadcasting, and provide technical guidance to FCC Commissioners and U.S. participants in international conferences. The FCC to date has: (1) tested five different small receive-only terminals under a great variety of environment conditions, thereby acquiring a wealth of operational experience as well as certain concrete experimental results; (2) accomplished the first (insofar as can be determined) actual satellite-to-home television reception; and (3) conducted many demonstrations of high power satellite television reception with small earth terminals, notably for FCC Chairman Charles D. Ferris and for members of Congressional and FCC Commissioners' staffs, as also for NHK and other Japanese visitors in advance of the March 1978 launch of the Japanese Broadcast Satellite Experiment (BSE). GRA

N79-30450# Federal Communications Commission, Washington, D. C. Spectrum Allocations Div.
MASTER FILE SEARCH SYSTEM (MFS): USER'S GUIDE
Feb. 1979 81 p refs
(PB-293289/5; FCC/OCE/SA-79/02) Avail: NTIS HC A05/MF A01 CSCL 17B

The Master File Search System program was developed as a spectrum allocation tool. The program generates and computes statistics about the existing licensee data file, i.e., a compressed subset of the master frequency file. The program can access the file via three search parameters--frequency, area, and date. These parameters can be specified by state-county names. There are several output reports which can be obtained--the user can obtain listings of the retrieved records, summary prints of the retrieval, and tabulation, and printer plots of transmitter, mobile units, and power densities. The retrieved records can be saved for future processing. Some of the tables in the report contain what appear to be gross errors. GRA

N79-30451# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
A STUDY OF TERRESTRIAL RADIO DETERMINATION: APPLICATIONS AND TECHNOLOGY Final Report, Sep. 1976 - Sep. 1977
J. E. Ward, M. E. Connelly, and A. K. Tetewsky Feb. 1979 207 p refs
(Contract DOT-TSC-1274)
(PB-293481/8; DOT-TSC-RSPA-79-2) Avail: NTIS HC A10/MF A01 CSCL 13F

The four basic terrestrial radio determination (TRD) technologies - hyperbolic, multilateration, proximity, and dead reckoning - are discussed and compared. Particular points of comparison are accuracy, coverage area, measurement rates, communication requirements, vehicular capacity, and fixed installations required. The problems of digital communications on landmobile radio channels are presented, existing TRD communications are described and compared, and some suggestions for improvement, perhaps involving development and FCC authorization of new types of radio channels, are presented. GRA

N79-30452# Federal Communications Commission, Washington, D. C. Data Automation Div.
DOMESTIC CHANNEL STUDY USER'S GUIDE Final Report
Mar. 1979 58 p
(PB-293671/4; FCC/DF-79/004A) Avail: NTIS HC A04/MF A01 CSCL 17B

User instructions are given for the channel study program

file. (There are 40 programs in this file in COBOL and FORTRAN languages.) GRA

N79-30453# National Technical Information Service, Springfield, Va.
ELECTROMAGNETIC SHIELDING, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1972 - May 1979
William E. Reed Jun. 1979 290 p
(NTIS/PS-79/0526) Avail: NTIS HC $28.00/MF $28.00 CSCL 09C

This updated bibliography contains 282 citations on electromagnetic shielding of electronic electrical equipment, personnel, and ordnance. The shielding effectiveness of materials and structures is covered. Nuclear electromagnetic pulse shielding is included. GRA

N79-30454# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
STRATEGIES FOR AUTOMATIC TRACK INITIATION
S. J. Rabinowitz, ed. (Mitre Corp., Bedford, Mass.) Jun. 1979 230 p refs In ENGLISH and FRENCH Presented at the Avionics Panel Specialists' Meeting, Monterey, Calif., 16-17 Oct. 1978 (AGARD-CP-252; ISBN-92-835-0236-1) Avail: NTIS HC A11/MF A01

The subjects of extraction of targets from clutter, automatic track initiation, and automatic tracking are covered. The application of various techniques to individual two dimensional and three dimensional radars, nets of two dimensional and three dimensional radars, and experimental phased array radars are presented. For individual titles, see N79-30455 through N79-30473.

N79-30455# Admiralty Surface Weapons Establishment, Portsdown (England).
AN AUTOMATIC TRACKING SYSTEM BASED ON THE STATIONARY PLOT FILTER
R. J. Tunnicliffe *In* AGARD Strategies for Autom. Track Initiation Jun. 1979 22 p refs (For primary document see N79-30454 21-32)
Avail: NTIS HC A11/MF A01

The design of an automatic tracking system applicable to shipborne non-moving target indicator radars is considered. The system is based on the stationary plot filter (SPF), which cancels stationary and slow moving detections and also provides data for both control of the first threshold and adaption of the track confirmation rules. The design of the system is discussed, with the emphasis on the SPF. Some experimental results are presented, which show how the performance of the filter is affected by the values of its parameters and also compares the performance of the SPF based approach with that of the more conventional moving target indication. J.M.S.

N79-30456# Lincoln Lab., Mass. Inst. of Tech., Lexington.
AUTOMATED TRACKING FOR AIRCRAFT SURVEILLANCE RADAR SYSTEMS
R. M. ODonnell and C. E. Muehe *In* AGARD Strategies for Autom. Track Initiation Jun. 1979 16 p refs (For primary document see N79-30454 21-32)
(Contracts DOT-FA72WAI-242; DOT-FA-TQ-679; F19628-78-C-0002)
Avail: NTIS HC A11/MF A01

An improved moving target detector (MTD) (a digital signal processor) was designed, constructed and tested which successfully rejects all forms of radar clutter while providing reliable detection of all aircraft within the coverage of the radar. Testing on both terminal and enroute surveillance radars is reported. This processor was integrated with automatic tracking algorithms to give complete rejection of ground clutter, heavy precipitation, and angels (birds). J.M.S.

N79-30457# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
BEAM STEERING AND SIGNAL PROCESSING WITH A PHASED ARRAY RADAR SYSTEM FOR AUTOMATIC TRACK INITIATION
Eberhard Hanle *In* AGARD Strategies for Autom. Track Initiation Jun. 1979 12 p refs (For primary document see N79-30454 21-32)
Avail: NTIS HC A11/MF A01

The relations between the main system functions search, acquisition, and tracking and their radar counterparts detection, interference reduction, and position finding of an experimental radar system (ELRA) are explained. For automatic track initiation a lot of radar tasks with different parameters are handled partly simultaneously and partly sequentially which demands various kinds of data transfer between the radar antennas and the tracking computer. It is pointed out that the radar physics and the tracking process require a variable integration time for optimum signal processing dependent on the target range, direction, and estimated cross section and on the information from a clutter map and that adaptive clutter suppression and jammer cancellation can be included with modest reduction of the efficiency. The demand for a high detection probability and location accuracy and limitations in power and time with long-range surveillance systems are overcome by a multiple-beam concept using interlaced transmit-receive processing. J.M.S.

N79-30458# Shape Technical Center, The Hague (Netherlands). Command Control and Systems Div.
DESIGN CONSIDERATIONS FOR RADAR TRACKING IN CLUTTER
H. B. Driessen *In* AGARD Strategies for Autom. Track Initiation Jun. 1979 14 p refs (For primary document see N79-30454 21-32)
Avail: NTIS HC A11/MF A01

The performance of an automatic tracking logic in a mixed environment of false and real plots is studied. The problem is investigated with Monte Carlo simulation. The investigation is a sensitivity analysis for five important parameters: (1) radar detection probability; (2) clutter density; (3) smoothing parameters; (4) gate size; and (5) maximum number of consecutive misses. The results are applicable to the design of a tracking logic of an automatic air traffic control system. J.M.S.

N79-30459# Plessey Radar Ltd., Addlestone (England).
SOME ASPECTS OF MULTI-RADAR TRACKING
A. R. Morley and A. S. Wilsdon *In* AGARD Strategies for Autom. Track Initiations Jun. 1979 14 p ref (For primary document see N79-30454 21-32)
Avail: NTIS HC A11/MF A01

Three different aspects of a multi-radar simulation study aimed at determining the best tracking organization and algorithms are presented. The first aspect is that of tracking groups of aircraft which are not all individually resolvable. Simulation showed that a manually defined quadrilateral enclosing the aircraft could be used for filtering the formation while tracking was performed by evaluating the centroid of the group and tracking it as a single entity. In any tracking system height is required primarily for tactical reasons, but in a multi-radar tracking system it is also required for the co-ordinate conversion of the measured plot position to the common tracking plane. There is therefore an additional requirement to produce accurate height information in order to improve the tracking performance. The height accuracy can, in general, be improved by height filtering. A possible algorithm is described. The implications of uncoupling the multi-radar Kalman filter are considered in terms of tracking performance. It is shown that under certain circumstances the tracking performance is considerably degraded when an uncoupled Kalman filter is implemented. A.R.H.

N79-30460# Elektronik-System G.m.b.H., Munich (West Germany).
ALGORITHMS FOR SIMULTANEOUS AUTOMATIC TRACK INITIATION IN MULTIPLE RADAR NETWORKS
Karl Brammer, Franz Herzmann, Albert Kainzinger, and Norbert Knoppik *In* AGARD Strategies for Autom. Track Initiation Jun. 1979 17 p refs (For primary document see N79-30454 21-32)
Avail: NTIS HC A11/MF A01

In a system which uses tracking facilities of equal authority collocated at every radar station, redundant communication links between the stations provide a failure tolerant data exchange capability. Algorithms are described which lead to a unique system track for a target entered into the system by several radar sensors, while each of the collocated tracking facilities starts an individual track by pooling radar information from its own sensor and from neighboring sensors seeing the same target. The functions

of automatic multiradar track initiation and management for echo targets are illustrated by some simulation results. Extension of the algorithms to strobe tracking and triangulation is outlined.
A.R.H.

N79-30461# General Research Corp., Santa Barbara, Calif.
A NETTING APPROACH TO AUTOMATIC RADAR TRACK INITIATION, ASSOCIATION, AND TRACKING IN AIR SURVEILLANCE SYSTEMS
Gary W. Deley *In* AGARD Strategies for Autom. Track Initiation Jun. 1979 10 p ref (For primary document see N79-30454 21-32)
Avail: NTIS HC A11/MF A01

One of several promising concepts for netting radars in a tactical air surveillance system employs track-while-scan radars having scan periods of from 4 to 12 seconds. Such scan periods are too long to yield an acceptably high probability of automatic association of measurements with tracks when the surveillance region contains many highly maneuverable targets. As presented, the radars overcome this limitation by being connected into a non-hierarchical net over which measurement data is pooled. In the system concept described, most targets will be seen by twenty or more radars. If all radars able to see a target shared the resulting data with the entire system, the communications bandwidth required would be excessive. To avoid this problem, an algorithm was devised that dynamically selects a 'best' subset of the system's radars to track each target, thus, simultaneously achieving a high probability of correct association (and hence of maintaining track) while requiring reasonable communications bandwidths. This performance is achieved without centralized control. The concept was verified using a detailed computer simulation called TACRAN (Tactical Air Control Radar Net); some simulation results are presented. A.R.H.

N79-30462# Societe Industrielle des Nouvelles Techniques Radioelectriques et de l'Electrique Francaise, Asnieres.
PRIMARY AUTOMATIC TRACKING RADAR IN A MILITARY APPROACH AND ASSEMBLY CENTER [POURSUITE AUTOMATIQUE RADAR PRIMAIRE DANS UN CENTRE D'APPROCHE ET DE RECUEIL MILITAIRE]
A. Poch *In* AGARD Strategies for Autom. Track Initiation Jun. 1979 5 p In FRENCH (For primary document see N79-30454 21-32)
Avail: NTIS HC A11/MF A01

Automatic tracking radar in a military center is confronted with problems related to both the environment and to operational exploitations. Special algorithms, adapted in an extremely short time, are used to process targets developing in dense zones at low altitudes, by performing the following functions: (1) constituting a moving map, supported in real time, by recognized plots of the coverage; (2) rapid automatic initiation on plots at contact, beginning from a self adaptive criteria, as a function of the creation zone in the radar coverage: assembly zone, landing/takeoff zone, surveillance zones; (3) associating contact-targets, considering the correct conditions for approach: fixed echoes, atmospheric clutter, speed, and the performance and location of very disparate targets; and(4) the automatic, real-time adaptation, of related parameters as a function of the development of targets: accelerations, decelerations, turning, and lack of radar detection. These algorithms are incorporated into a compact program and used on a minicomputer.
Transl. by A.R.H.

N79-30463# Communications Research Centre, Ottawa (Ontario). Communications Dept.
ANALYSIS OF SECOND AND THIRD ORDER STEADY-STATE TRACKING FILTERS
A. W. Bridgewater *In* AGARD Strategies for Autom. Track Initiation Jun. 1979 11 p refs Sponsored by the Dept. of Natl. Defence, Ottawa, Ontario (For primary document see N79-30454 21-32)
Avail: NTIS HC A11/MF A01

In a multi-target environment, the heavy processing load on even the most powerful radar tracking systems makes it necessary to sacrifice theoretical optimality for practical feasibility in the tracking process. One approach is to adopt sub-optimal methods for track estimation using steady-state adaptive alpha-beta and alpha-beta-gamma filters, which are derived from the Kalman filter and which combine good track-following ability, ease of adaptation to changes in the tracking conditions, and low computational cost. A theoretically-derived functional relationship between the set of gain coefficients and a system parameter which quantifies the current tracking conditions permits a rapid and near optimal response to any changes in those conditions. An economical means is developed to incorporate this adaptive feature in a tracking system. Coordinate-transformation techniques are described and other aspects of practical implementation of this type of tracking filter are also examined. A.R.H.

N79-30464# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
AUTOMATIC TRACK INITIATION FOR A PHASED ARRAY RADAR USING A CLUTTER MAP
Wilhelm Fleskes *In* AGARD Strategies for Autom. Track Initiation Jun. 1979 11 p refs (For primary document see N79-30454 21-32)
Avail: NTIS HC A11/MF A01

A statistical method for track validation was introduced which uses a sequential likelihood ratio test procedure. The test discriminates between tracks of the wanted objects and false tracks on the basis of the target detection probability and the local false alarm probability. The latter is estimated for each search plot in a clutter map which is a list of stored clutter echos. The map is updated in real time and the list organization technique provides a set of converging volumina containing the estimation point so that nonparametric estimates can be obtained by testing on uniformity. Core memory and computing time requirements allow real time operation in a multipurpose computer programmed in higher level language. M.M.M.

N79-30465# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
SOFTWARE STRUCTURE AND SAMPLING STRATEGY FOR AUTOMATIC TARGET TRACKING WITH A PHASED ARRAY RADAR
G. vanKeuk *In* AGARD Strategies for Autom. Track Initiation Jun. 1979 13 p refs (For primary document see N79-30454 21-32)
Avail: NTIS HC A11/MF A01

The software system used for multi-target tracking in the experimental phased array system under construction at the FFM is described as well as the introduction on the application to Kalman filters for tracking maneuvering targets. In contrast of the situation with conventional radars, the additional degree of freedom to adapt the scan period on the estimated lack of information with regard to each individual track is analyzed for the electronically steerable radar case. A sampling strategy is developed and analyzed that minimizes the tracking frequency considering the shape of the detection probability within a tracking beam pointing towards the predicted target position. Adapting the scan interval a constant track accuracy in space can be achieved taking the various dynamical and geometrical restrictions into consideration. An optimal spatial extension of this uncertainty volume can then be derived. As the sampling frequency of course also depends on the assumed maneuvering capabilities of the target under track, the extension of the optimal uncertainty volume depends only on the beam splitting ratio of the used monopulse angle finding technique. M.M.M.

N79-30466# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
THE FORMATION TRACKING PROCEDURE FOR TRACKING IN DENSE TARGET ENVIRONMENT
G. Binias *In* AGARD Strategies for Autom. Track Initiation Jun. 1979 11 p refs (For primary document see N79-30454 21-32)
Avail: NTIS HC A11/MF A01

The strategy of formation tracking presented is characterized by the substitution of raid tracks for single target tracks. The raid tracks are correlated and updated by plot-clusters. The formation track consists of one central track and several marginal tracks containing the whole information about the mean cinematical behavior and the spatial extension of the tracked formation. Special investigations were directed to the following problems: formation track initiation, formation track evolution, decision and control procedures with regard to formation track

splitting, and formation track junction. The efficiency of formation tracking can be demonstrated by a few one dimensional examples of appropriate airspace situations. M.M.M.

N79-30467# Mitre Corp., Bedford, Mass.
PERFORMANCE OF AUTOMATIC TRACK INITIATION LOGIC IN SPECIFIC TARGET ENVIRONMENTS
G. E. Lindeberg, A. S. Margulies, and P. A. Smyton *In* AGARD Strategies for Autom. Track Initiation Jun. 1979 10 p refs (For primary document see N79-30454 21-32)
(Contract F19628-78-C-0001)
Avail: NTIS HC A11/MF A01

Two generalized analytical computer models were developed to provide data for a parametric assessment of various ATI algorithms which attempt to replicate the surveillance operator's judgmental processes. One model was used to investigate the initiation of tracks on actual targets and the other was used to determine the track initiation performance based only upon false reports. This performance dichotomy is valid for the anticipated NAEW target environment. It was concluded that there are several ATI algorithms which would yield satisfactory performance. Even within this set of acceptable algorithms, however, some criteria provide enhanced performance in initiation of true targets at the expense of a relatively larger number of false track initiations and there are others for which the converse is true. The level of false target reports per scan, the expected target speeds, and the speed with which real targets are initiated are all significant factors in the construction of the ATI feature and their ramifications are discussed in detail. M.M.M.

N79-30468# Naval Research Lab., Washington, D. C.
INITIATION OF TRACKS IN A DENSE DETECTION ENVIRONMENT
J. D. Wilson and G. V. Trunk *In* AGARD Strategies for Autom. Track Initiation Jun. 1979 18 p refs (For primary document see N79-30454 21-32)
Avail: NTIS HC A11/MF A01

In a dense detection environment present track-while-scan algorithms are expected to introduce false tracks when processing is performed on a scan-by-scan basis. The maximum likelihood solution involving all detections on all scans is formulated and evaluated for the initiation problem. While the maximum likelihood method cannot be implemented because of the enormous computational requirements, it provides a standard to which more implemental algorithms (such as a raid detector) can be compared. M.M.M.

N79-30469# Federal Aviation Administration, Washington, D. C.
AUTOMATIC RADAR TRACKING IN TERMINAL AIR TRAFFIC CONTROL FACILITIES
Hugh G. McEvoy *In* AGARD Strategies for Autom. Track Initiation Jun. 1979 7 p refs (For primary document see N79-30454 21-32)
Avail: NTIS HC A11/MF A01

A radar tracking system was developed for use in the terminal area. The extractor is referred to as a Sensor Receiver and Processor (SRAP). It detects both primary radar and secondary radar targets and correlates the two for transmission to the central computer. The primary radar extractor portion of the SRAP employs a rank order quantizer as the first detector so that quantizing of signals is done on a non-parametric basis. The device also employs a dynamic correlation measurement technique to produce a tight clutter false alarm control. The automatic radar terminal system 3 computer program was modified to accept data already azimuthally correlated between primary and secondary signals. Author

N79-30470# Royal Netherlands Navy, Den Helder (Netherlands).
EXPERIENCE WITH AUTOMATIC TRACKING SYSTEMS OF THE ROYAL NETHERLANDS NAVY
Leo Stigter *In* AGARD Strategies for Autom. Track Initiation Jun. 1979 7 p (For primary document see N79-30454 21-32)
Avail: NTIS HC A11/MF A01

The problems encountered and the experience gained with automatic tracking systems for the modern frigates of the Royal Netherlands Navy are described. The on board data handling system DAISY (digital automated information processing system) was studied. R.E.S.

N79-30471# Litton Systems, Inc., Van Nuys, Calif. Data Systems Div.
THE REMOTE RADAR TRACKING STATION
Frank P. Hiner, III *In* AGARD Strategies for Autom. Track Initiation Jun. 1979 8 p refs (For primary document see N79-30454 21-32)
Avail: NTIS HC A11/MF A01

The development of the remote radar tracking station (RRTS) is described. The capabilities of the RRTS are discussed in detail. R.E.S.

N79-30472# IBM France S. A., Paris.
BASIC CONCEPTS OF RADAR DATA PROCESSING IN THE STRIDA
G. Grolleron and A. Clanet *In* AGARD Strategies for Autom. Track Initiation Jun. 1979 4 p (For primary document see N79-30454 21-32)
Avail: NTIS HC A11/MF A01

Radar data processing in STRIDA is carried out by three types of processing: (1) extraction (which digitalizes, extracts and filters radar information); (2) tracking (which elaborates and updates the group of tracks for each radar); and (3) merging (which enables the establishment of a general air traffic chart). These functions are entirely automatic and are implemented in the different network centers. The process of initiation and update of tracks is performed in two steps: firstly, at a mono-radar level, and then, at a multi-radar level. This technique gives the advantage of limiting the number of false tracks while being sure of creating every new track. It also enables the establishment of a general air traffic chart by dynamically choosing the best radar detection for each track. R.E.S.

N79-30473# Hughes Aircraft Co., Fullerton, Calif. System Analysis Section.
ESTABLISHMENT OF AIR DEFENSE SENSOR REQUIREMENTS FOR AUTOMATIC AIRCRAFT TRACKING
Martin Dana *In* AGARD Strategies for Autom. Track Initiation Jun. 1979 10 p (For primary document see N79-30454 21-32)
Avail: NTIS HC A11/MF A01

The functional relationship between air defense requirements and the capabilities of the target acquisition, tracking, identification, threat evaluation and weapon assignment, and weapon subsystems was investigated. Some alternative methods for assessing quantitatively the relationship between total air defense system performance and the performance of the individual subsystems are discussed. A detailed analytic model of system versus subsystem performance was derived. The sensor and sensor processing related functions--that is, acquisition, tracking, identification and acquisition of designed targets by fire control radars--were emphasized in the derivation. Although the communication subsystem is a vital element of an integrated air defense system, communications was not considered except to note that a system which can transmit the required information to and from the command and control subsystem without excessive delays due to traffic and queueing problems is required. R.E.S.

N79-30254*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Communications Systems Research Section.
A GENERALIZATION OF BINARY MINIMUM SHIFT KEYING AND STAGGERED QUADRIPHASE SHIFT KEYING MODULATION
J. L. Massey *In its* The Deep Space Network 15 Aug. 1979 p 26-40 refs (For primary document see N79-30248 21-12)
Avail: NTIS HC A06/MF A01 CSCL 17B

N79-30256*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Radio Frequency and Microwave Subsystems Section.
A PROTOTYPE DSN X-S BAND FEED: DSS 13 APPLICATION Status Report
W. Williams, D. Nixon, H. Reilly, J. Withington, and D. Bathker *In its* The Deep Space Network 15 Aug. 1979 p 51-60 refs (For primary document see N79-30248 21-12)
(SR-3) Avail: NTIS HC A06/MF A01 CSCL 20N

N79-30259*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Radio Frequency and Microwave Subsystems Section.
NEW X-BAND ANTENNA FEEDS FOR THE DSN 64-METER STATIONS
R. Hartop *In its* The Deep Space Network 15 Aug. 1979 p 71-74 refs (For primary document see N79-30248 21-12)
Avail: NTIS HC A06/MF A01 CSCL 17B

N79-30261*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Deep Space Station 62.
PRELIMINARY REPORT ON DSN SYSTEM PERFORMANCE UNDER LOCAL WEATHER EFFECTS
J. M. Urech *In its* The Deep Space Network 15 Aug. 1979 p 82-88 refs (For primary document see N79-30248 21-12)
Avail: NTIS HC A06/MF A01 CSCL 20N

N79-30263*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. DSN Engineering Section.
MINIMIZING THE RMS SURFACE DISTORTIONS FROM GRAVITY LOADINGS OF THE 34-m HA-DEC ANTENNA FOR DEEP SPACE MISSIONS
S. M. Katow *In its* The Deep Space Network 15 Aug. 1979 p 94-98 refs (For primary document see N79-30248 21-12)
Avail: NTIS HC A06/MF A01 CSCL 20N

N79-30264*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Telecommunications Systems Section.
INTERIM RADIO SPECTRUM SURVEILLANCE STATION
D. R. Hersey *In its* The Deep Space Network 15 Aug. 1979 p 99-107 refs (For primary document see N79-30248 21-12)
Avail: NTIS HC A06/MF A01 CSCL 17B

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N79-30474*# Component Research Co., Santa Monica, Calif.
IMPROVEMENT OF THE MECHANICAL AND THERMAL PROPERTIES OF THE METALLIZED POLYCARBONATE CAPACITOR Final Technical Report, 28 Jan. - 30 Jun. 1977
Hillel J. Kellerman Aug. 1977 194 p
(Contract NAS8-32403)
(NASA-CR-150460) Avail: NTIS HC A09/MF A01 CSCL 09A

Changes were studied which enable polycarbonate metallized film capacitors to withstand 500 thermal shock cycles while maintaining electrical characteristic integrity without becoming intermittent, and without losing hermeticity. The task was for metallized polycarbonate film capacitors designed to meet MIL-C-39022/9 and MIL-C-83421/1. The capacitor design improvements implemented were the insertion of a rubber washer between spray cap and end seal and the utilization of a flexible lead assembly. One hundred fifty capacitors incorporating the design improvements were manufactured and subsequently underwent 500 thermal shock cycles. One hundred forty nine capacitors survived the test. Failure analysis revealed that the lone failure was due to a poor solder joint, initially detected in pre-screening tests as having poor dissipation factor and equivalent series resistance measurement readings. F.O.S.

N79-30475*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
C-MOS BULK METAL DESIGN HANDBOOK
Teddy M. Edge Jul. 1977 141 p
(NASA-TM-78126) Avail: NTIS HC A07/MF A01 CSCL 09C

The LSI standard cell array technique was used in the fabrication of more than 20 CMOS custom arrays. This technique consists of a series of computer programs and design automation techniques referred to as the Computer Aided Design And Test (CADAT) system that automatically translate a partitioned logic diagram into a set of instructions for driving an automatic plotter which generates precision mask artwork for complex LSI arrays of CMOS standard cells. The standard cell concept for producing LSI arrays begins with the design, layout, and validation of a group of custom circuits called standard cells. Once validated, these cells are given identification or pattern numbers and are permanently stored. To use one of these cells in a logic design, the user calls for the desired cell by pattern number. The Place, Route in Two Dimension (PR2D) computer program is then used to automatically generate the metalization and/or tunnels to interconnect the standard cells into the required function. Data sheets that describe the function, artwork, and performance of each of the standard cells, the general procedure for implementation of logic in CMOS standard cells, and additional detailed design information are presented. J.M.S.

N79-30476*# RCA Advanced Technology Labs., Camden, N. J.
DESIGN RULES FOR RCA SELF-ALIGNED SILICON-GATE CMOS/SOS PROCESS
Mar. 1977 31 p
(Contract NAS8-31325)
(NASA-CR-150320) Avail: NTIS HC A03/MF A01 CSCL 09C

The CMOS/SOS design rules prepared by the RCA Solid State Technology Center (SSTC) are described. These rules specify the spacing and width requirements for each of the six design levels, the seventh level being used to define openings in the passivation level. An associated report, entitled Silicon-Gate CMOS/SOS Processing, provides further insight into the usage of these rules. F.O.S.

N79-30477# Florida Inst. of Tech., Melbourne. Dept. of Electrical Engineering.
FEDERAL AVIATION ADMINISTRATION FLORIDA INSTITUTE OF TECHNOLOGY WORKSHOP ON GROUNDING AND LIGHTNING TECHNOLOGY Final Report
May 1979 99 p refs Workshop held at Melbourne, Fla., 6-8 Mar. 1979 Sponsored by FAA
(AD-A070779; FAA-RD-79-6-Suppl-1A) Avail: NTIS HC A05/MF A01

The articles presented were entitled: (1) Lightning Effects on General Aviation Aircraft; (2) A New Approach to Lightning Positioning and Tracking; (3) Design, Development and Fabrication of Devices for the Protection of Electronic Equipment Against Ligtning; (4) Lightning Fatalities: Can They be Prevented?; and (5) Ligtning Test Waveforms and Techniques for Aerospace Vehicles and Hardware. M.M.M.

N79-30478*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
A USER ORIENTED COMPUTER PROGRAM FOR THE ANALYSIS OF MICROWAVE MIXERS, AND A STUDY OF THE EFFECTS OF THE SERIES INDUCTANCE AND DIODE CAPACITANCE ON THE PERFORMANCE OF SOME SIMPLE MIXERS
P. H. Siegel and A. R. Kerr Jun. 1979 122 p refs
(NASA-TM-80324) Avail: NTIS HC A06/MF A01 CSCL 09C

A user oriented computer program for analyzing microwave and millimeter wave mixers with a single Schottky barrier diode of known I-V and C-V characteristics is described. The program first performs a nonlinear analysis to determine the diode conductance and capacitance waverforms produced by the local oscillator. A small signal linear analysis is then used to find the conversion loss, port impedances, and input noise temperature of the mixer. Thermal noise from the series resistance of the diode and shot noise from the periodically pumped current in the diode conductance are considered. The effects of the series inductance and diode capacitance on the performance of some simple mixer circuits using a conventional Schottky diode, a Schottky diode in which there is no capacitance variation, and a Mott diode are studied. It is shown that the parametric effects of the voltage dependent capacitance of a conventional Schottky diode may be either detrimental or beneficial depending on the diode and circuit parameters. K.L.

N79-30479# Boeing Aerospace Co., Seattle, Wash.
HIGH VOLTAGE SPECIFICATIONS AND TESTS, AIRBORNE EQUIPMENT Final Report, 17 Aug. 1977 - 30 Sep. 1978
W. G. Dunbar and W. P. Koenig Apr. 1979 547 p refs
(Contract F33615-77-C-2054; AF Proj. 3145)
(AD-A069473; AFAPL-TR-79-2024) Avail: NTIS HC A23/MF A01 CSCL 09/5

Design engineers rely upon system and component standards and specifications as guides for developing electrical equipment. Specifications and standards are available for most low voltage and commercial high voltage equipment, but not for high voltage/high power airborne equipment with ratings exceeding 20KV and 20KW. The test and specification criteria (Engineering Criteria Documents) referred to in this paper pertain to high voltage/high power airborne. GRA

N79-30480# Naval Research Lab., Washington, D. C.
ANALYTIC SCALING OF EFFICIENCY FOR THE GYROTRON TRAVELING WAVE AMPLIFIER OPERATING AT CYCLOTRON HARMONICS Interim Report
K. R. Chu, A. T. Drobot (Science Applications, Inc., McLean, Va.), H. H. Szu, and P. Sprangle 15 May 1979 13 p refs
(Contract MIPR-FY-619-70026)
(AD-A069618; NRL-MR-3892) Avail: NTIS HC A02/MF A01 CSCL 09/1

An analytical expression for the efficiency of the gyrotron travelling wave amplifier is derived for the case of nonfundamental cyclotron harmonic operation. It scales the efficiency with respect to the modes and parameters of operation and gives the conditions for optimum performance. GRA

N79-30481# Edgerton, Germeshausen and Grier, Inc., Salem, Mass. Electronic Components Div.
REPETITIVE SERIES INTERRUPTER 2 Final Report
Robert F. Caristi and David V. Turnquist Apr. 1979 139 p refs
(Contract DAAB07-76-C-1301; DA Proj. 1L1-62705-AH-94)
(AD-A069840; DELET-TR-76-1301-F) Avail: NTIS HC A07/MF A01 CSCL 09/5

This report summarizes the results of the work performed under the Repetitive Series Interrupter Program. The fundamental aims were to obtain the information necessary to build five exploratory development RSI's designed to interrupt 1000 A at 50 kV, to construct these tubes, and to evaluate their performance under conditions simulating their intended usage. The relatively low-voltage 10 Series of RSI's built under the initial phase of the Program were characterized for both interruption capability and forward voltage drop. Using the 10 Series tubes, investigations were also made to determine the extent to which the self-interruption tendency of a constricted, high current gas discharge would affect the interruption process. The conclusion was that the self-interruption process in no way hindered RSI operation, and in fact operated so as to reduce the magnetic field necessary to interrupt a given discharge. GRA

N79-30482# Naval Research Lab., Washington, D. C.
ELECTRONIC MATERIAL TECHNOLOGY Interim Report, 1 Oct. 1977 - 1 Oct. 1978
H. Lessoff 18 May 1979 31 p refs
(ZF5458001)
(AD-A069471; NRL-MR-4004) Avail: NTIS HC A03/MF A01 CSCL 20/12

This report discusses the programs and progress made in the in-house portion of the Electronic Materials Program. The growth of semi-insulating III-V semiconductors using oxygen doping is discussed, including electrical and device characterization. Results of indium phosphide material preparation and bulk single cyrstals as well as epitaxial films growth are summarized. High magnetostrictive materials have initial permeability and coupling constants increased by nearly an order of magnitude. GRA

N79-30483# Naval Research Lab., Washington, D. C.
DESIGN PARAMETERS FOR A GYRO-TWA OPERATING AT THE SECOND CYCLOTRON HARMONIC
K. R. Chu, V. L. Granatstein, and A. T. Drobot 14 May 1979 16 p ref
(MIPR-FY-7619-70026; XF54581007)
(AD-A069736; NRL-MR-3950) Avail: NTIS HC A02/MF A01 CSCL 20/7

Designs for a 10 GHz gyrotron travelling wave amplifier are made on the basis of recent gyrotron theory. The amplifier operates on the TE sub 01 waveguide mode at the second electron cyclotron harmonic frequency. Although the designs are for specific systems, the design procedures as well as the trend shown in the various design options are of general interest. GRA

N79-30484# Los Alamos Scientific Lab., N. Mex.
IMAGE RESTORATION WITH A LOCALLY VARIABLE WIENER FILTER
Martin J. Lahart 1979 8 p refs
(Contract W-7405-eng-36)
(LA-UR-79-897; Conf-790510-1) Avail: NTIS HC A02/MF A01

The parametric Wiener filter is used to deblur images that are relatively noise free. If noise is more severe, the restored image may be obscured by a granular pattern that results when the noise is subjected to the deblurring filter. This effect is reduced by using a larger noise parameter leading to a restoration that is less sharp. Variation of the noise parameter from pixel to pixel so that it is larger only where noise is greater is described. Pixels with low signal-to-noise ratios are identified by a thresholding process and comparison with nearest neighbors. The effects of the estimated Wiener spectra on the restored image are discussed. DOE

N79-30485# California Univ., Livermore. Lawrence Livermore Lab.
EUROPEAN ECONOMIC COMMUNITIES SYMPOSIUM ON COMPUTER-AIDED DESIGN OF DIGITAL ELECTRONIC CIRCUITS AND SYSTEMS
W. G. Magnuson, Jr. and C. W. Gwyn (Sandia Labs., Albuquerque, N. Mex.) Dec. 1978 32 p Symp. held at Brussels, 27-29 Nov. 1978
(UCID-18154) Avail: NTIS HC A03/MF A01

The history, goals, conclusions, and recommendations of a feasibility study on computer-aided design of digital circuits and systems are outlined. Emphasis is placed on the general philosophy of computer-aided design of integrated circuits and printed circuit boards. Simulation, modeling, and test w sequence generation are included. DOE

N79-30486# General Electric Co., Pittsfield, Mass.
ELECTROSTATIC AND ELECTROMAGNETIC EFFECTS OF ULTRAHIGH-VOLTAGE TRANSMISSION LINES Final Report
D. W. Deno Jun. 1978 368 p refs
(EPRI Proj. 566-1)
(EPRI-EL-802) Avail: NTIS HC A16/MF A01

Results of research on electric and magnetic field effects of high voltage ac power lines, are reported. Calculation methods and measuring techniques were developed for transmission line fields and their effects. Steady state and spark discharge currents induced in persons and objects were investigated with laboratory and full scale tests using a three-phase UHV line. Different methods to reduce the electric field of UHV lines were investigated, such as grids of grounded wires and lower voltage circuits built underneath the UHV lines. Unusual effects of high electric fields, such as people's reaction to various types of exposures, wood pole burning, and corona on grounded objects, were experienced during the operation of the UHV three-phase test line. These effects were investigated and design data are provided. DOE

N79-30487# Oak Ridge National Lab., Tenn.
DEVELOPMENT AND TESTING OF TOROIDAL FIELD SUPERCONDUCTORS FOR FUSION DEVICES
W. A. Fietz, J. W. Lue, and J. R. Miller 1978 11 p refs Presented at the 7th Cryogenic Eng. Conf., London, 4 Jul. 1978
(Contract W-7405-eng-26)
(CONF-780718-1) Avail: NTIS HC A02/MF A01

Superconductors rated at 10-16 kA in a magnetic field of 8 T are being designed, manufactured, and tested in cooperative development programs between Oak Ridge National Laboratory (ORNL) and conductor manufacturers. Conductor specimens based on ideas previously submitted by the manufacturers were

fabricated and tested along with others designed and fabricated at ORNL. The tests measure short sample currents, stability, pressure drop, and heat transfer. Conductor parameters include strand size, cable configuration, superconductor distribution within the conductor, and compaction. DOE

N79-30488# European Space Agency, Paris (France).
MODELIZATION OF THE INFLUENCE OF AN ACCELERATION ON THE FREQUENCY OF QUARTZ RESONATORS
Denis Janiaud May 1979 132 p refs Transl. into ENGLISH of 'Modelisation de l'Influence d'une Acceleration sur la Frequence des Resonateurs a Quartz', ONERA, Paris Report ONERA-NT-1978-3, 30 Mar. 1978
(ESA-TT-551; ONERA-NT-1978-3) Avail: NTIS HC A07/MF A01

Some theoretical assumptions are proposed for modeling the resonator parameters most sensitive to acceleration. They show the prime importance of the configuration of the crystal supports. A quartz resonator was constructed based on these theoretical conclusions. Its sensitivity to acceleration is noticeably lower than that of conventional resonators. Author (ESA)

N79-30489# Siemens A.G., Erlangen (West Germany). Forschungslaboratorien.
SUPERCONDUCTING NIOBIUM RESONATORS Final Report
Heinrich Diepers, Bernhard Hillenbrand, Hans Martens, Kurt Schnitzke, Yilmaz Uzel, and G. Ziegler Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1977 78 p refs In GERMAN; ENGLISH summary
(Contract BMFT-NT-124-2)
(BMFT-FB-T-77-77) Avail: NTIS HC A05/MF A01; ZLDI, Munich DM 15,95

Investigations on superconducting resonators made from Nb, having undergone various pretreatment processes, showed that with cold worked Nb only small critical flux densities are possible, but that with fine grained recrystallized Nb larger values can be obtained. Application of Nb3Sn instead of Nb gives higher operating temperatures for superconducting accelerators as well as a better thermal stability. Procedures were developed to grow Nb3Sn on Nb-resonators (Sn from vapor phase, several hours at 1050t C). At 1.5 K quality factors up to 6 x 1,000,000,000 and critical flux density values of 100 mT were achieved, while at 4.2 k quality factors up to 2.7 x 1,000,000,000 were reached. Author (ESA)

N79-30490# Civil Aeromedical Inst., Oklahoma City, Okla.
ELECTRICAL INSULATION FIRE CHARACTERISTICS. VOLUME 2: TOXICITY Final Report, Jul. 1976 - Jul. 1978
Charles R. Crane, Boyd R. Endecott, Donald C. Sanders, and John K. Abbott Dec. 1978 102 p refs
(Contracts DOT/TSC-RA-77-15; DOT/TSC-RA-77-16)
(PB-294841/2; UMTA-MA-06-0025; DOT-TSC-UMTA-78-48-11) Avail: NTIS HC A06/MF A01 CSCL 13F

The relative inhalation toxicity of the thermal degradation products or gaseous pyrolysis of selected types of electrical wiring insulations was determined. The specific materials to be evaluated were selected from a much larger population on the basis of prior testing of properties other than toxicity. The relative toxicities of the combustion products of 14 electrical wiring insulations were evaluated using animal incapacitation as a measure of toxicity. One gram insulation samples were pyrolyzed in a quartz combustion tube connected in-line with a 12.6 liter exposure chamber by an air recirculation assembly to form a closed exposure system. Each material was pyrolyzed under three thermal degradation conditions and the time to incapacitation for the shortest time condition was used to rank the materials in order of their relative potential toxicity. GRA

N79-30491# Boeing Commercial Airplane Co., Seattle, Wash.
ELECTRICAL INSULATION FIRE CHARACTERISTICS. VOLUME 1: FLAMMABILITY TESTS Final Report, Jul. 1976 - Jul. 1978
L. E. Meyer, A. M. Taylor, and J. A. York Dec. 1978 247 p
(Contract DOT-TSC-1221)
(PB-294840; UMTA-MA-06-0025-79-1; DOT-TSC-UMTA-78-48-1) Avail: NTIS HC A11/MF A01 CSCL 13F

Standard flammability, smoke emission, and circuit integrity tests were developed for electrical wire and cable insulating materials used in rapid transit system vehicles and wayside and track installations. Currently used materials were tested to determine whether they can provide a fire safe environment in terms of low flame propagation, smoke emission, and gas evolution. GRA

N79-30492# National Technical Information Service, Springfield, Va.
MICROWAVE OSCILLATORS, VOLUME 1. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1955 - 1977
William E. Reed May 1979 256 p
(NTIS/PS-79/0415/4) Avail: NTIS HC $28.00/MF $28.00 CSCL 09E

The bibliography cites reports from worldwide research on the design, performance, properties, and applications of microwave oscillators, including Gunn, IMPATT, transistor, TRAPATT, transferred electron, Schottky, and surface acoustic wave oscillators. (This updated bibliography contains 250 abstracts, none of which are new entries to the previous edition). GRA

N79-30493# National Technical Information Service, Springfield, Va.
MICROWAVE OSCILLATORS, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1978 - Mar. 1979
William E. Reed May 1979 131 p Supersedes NTIS/PS-78/0334; NTIS/PS-77/0300; NTIS/PS-76/0313
(NTIS/PS-79/0416/2; NTIS/PS-78/0334; NTIS/PS-77/0300; NTIS/PS-76/0313) Avail: NTIS HC $28.00/MF $28.00 CSCL 09E

Worldwide research on the design, performance, properties, and applications of microwave oscillators, including Gunn, IMPATT, transistor, TRAPATT, transferred electron, Schottky, and surface acoustic wave oscillators is presented. (This updated bibliography contains 126 abstracts, 124 of which are new entries to the previous edition.) GRA

N79-30494# National Bureau of Standards, Washington, D. C. Electron Devices Div.
SEMICONDUCTOR MEASUREMENT TECHNOLOGY: A REVERSE-BIAS SAFE OPERATING AREA TRANSISTOR TESTER Final Report, Dec. 1976 - Jun. 1978
David W. Berning Mar. 1979 47 p refs
(PB-294248/0; NBS-SP-400-54; LC-78-600157) Avail: NTIS HC A03/MF A01 CSCL 14B

A construction guide is presented for a reverse bias safe operating area transistor tester for npn switching transistors. Principles of operation for various circuits in the tester are discussed, as well as those of the complete system. System specifications are given along with hints on chassis layout. Complete circuit schematics with additional detail pertaining to power supply and grounding interconnections, mechanical drawings of the tester enclosure, and photographs are included. Special components such as the collector load inductor are described. A section on the use of the tester includes waveforms generated by a typical test that would be made on a transistor with this equipment. GRA

N79-30495# National Technical Information Service, Springfield, Va.
GUNN EFFECT DEVICES, VOLUME 2 Report, Mar. 1976 - Mar. 1979
William E. Reed Jun. 1979 296 p Supersedes NTIS/PS-78/0362; NTIS/PS-77/0257
(NTIS/PS-79/0599; NTIS/PS-78/0362; NTIS/PS-77/0257) Avail: NTIS HC $28.00/MF $28.00 CSCL 09A

The application of Gunn effect devices to microwave generation, amplification, and control is presented. The Gunn effect in semiconductors is discussed. Design, fabrication, and properties of Gunn diodes are included. (This updated bibliography contains 290 abstracts, 67 of which are new entries to the previous edition.) GRA

N79-30496# Pennsylvania State Univ., University Park. Dept. of Mineral Engineering.

A COLD-BEND TEST FOR THERMOPLASTIC CABLE JACKETS
R. H. King, L. A. Morley, and J. N. Tomlinson 29 Aug. 1978 20 p refs
(Contract DI-BM-GO-155197)
(PB-294654/9; BM-OFR-38-79) Avail: NTIS HC A02/MF A01 CSCL 09A

A very simple cold-bend test was devised and tested for evaluating thermoplastic jackets used on mine-power-feeder cables. A test sample was bent into a semicircle whose radius was equal to the minimum bend radius recommended by IPCEA and then cooled to the desired test temperature (35 C). While at temperature, the sample was straightened by pulling the cable ends with a winch arrangement. The results show that of the jackets tested, those which cannot withstand the test literally burst when the samples were straightened. GRA

N79-30497# National Bureau of Standards, Washington, D. C. National Engineering Lab.
SEMICONDUCTOR TECHNOLOGY PROGRAM, PROGRESS BRIEFS Interim Report, Jul. - Sep. 1978
W. Murray Bullis Jan. 1979 12 p Sponsored in part by DOE, DNA, Charles Stark Draper Lab., Army Electronics Research and Development Command, AFAL, Navy Material Command, and NWSC
(ARPA Order 2397)
(PB-294846/1; NBSIR-79-1591) Avail: NTIS HC A02/MF A01 CSCL 09A

Information on measurement technology for semiconductor materials, process control, and devices is presented. Highlighted activities include studies of (1) laser annealing of low fluence implants in silicon; (2) analysis techniques for spreading resistance profiling measurements; (3) Hall effect measurements in two layer structures; (4) incorporation of hydrogen and hydroxyl impurities in silicon dioxide films; (5) an integrated gated-diode electrometer test structure; (6) defect density profiling by constant-capacitance deep-level transient spectroscopy; and (7) a spatial integrity test pattern for electrical measurement of intra- and inter-die line width variations. GRA

N79-30251*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Radio Frequency and Microwave Subsystems Section.
GYROTRON: A HIGH-FREQUENCY MICROWAVE AMPLIFIER
A. Kupiszewski *In its* The Deep Space Network 15 Aug. 1979 p 8-12 refs (For primary document see N79-30248 21-12)
Avail: NTIS HC A06/MF A01 CSCL 09A

N79-30255*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Communications Systems Research Section.
INTERNAL NOISE OF A PHASE-LOCKED RECEIVER WITH A LOOP-CONTROLLED SYNTHESIZER
C. A. Greenhall *In its* The Deep Space Network 15 Aug. 1979 p 41-50 refs (For primary document see N79-30248 21-12)
Avail: NTIS HC A06/MF A01 CSCL 09A

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related i formation see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N79-30498 British Library Lending Div., Boston Spa (England).
THERMAL STUDY OF NATURAL CONVECTION EFFECTS OF GAS IN ANNULAR SPACES: HEAT EXCHANGER PENETRATION OF THE PHENIX REACTOR
J. P. Kung 7 Dec. 1978 16 p refs Transl. into ENGLISH from paper NR-25, 6th Intern. Heat Transfer Conf. (Toronto), 1978 16 p Presented at the 6th Intern. Heat Transfer Conf., Toronto, 7-11 Aug. 1978
(BLL-Risley-TR-4015-(9091.9F)) Avail: British Library Lending Div., Boston Spa, Engl.

Gas circulation in annular spaces was studied, and the methods of calculation as applied to SUPER-PHENIX were confirmed. The temperatures in the heat exchanger penetration of PHENIX were calculated and the wall temperatures were compared with those measured on PHENIX during its operation. Results obtained were satisfactory: the maximum differences between calculated and measured values are less than 20 C for wall temperatures varying from 50 to 500 C. M.M.M.

N79-30499*# B & K Engineering, Inc., Towson, Md.
DEVELOPMENT OF CRYOGENIC THERMAL CONTROL HEAT PIPES Final Report
Aug. 1978 40 p refs
(Contract NAS2-9613)
(NASA-CR-152302; BK042-1012) Avail: NTIS HC A03/MF A01 CSCL 20D

The development of thermal control heat pipes that are applicable to the low temperature to cryogenic range was investigated. A previous effort demonstrated that stainless steel axially grooved tubing which met performance requirements could be fabricated. Three heat pipe designs utilizing stainless steel axially grooved tubing were fabricated and tested. One is a liquid trap diode heat pipe which conforms to the configuration and performance requirements of the Heat Pipe Experiment Package (HEPP). The HEPP is scheduled for flight aboard the Long Duration Flight Exposure Facility (LDEF). Another is a thermal switch heat pipe which is designed to permit energy transfer at the cooler of the two identical legs. The third thermal component is a hybrid variable conductance heat pipe (VCHP). The design incorporates both a conventional VCHP system and a liquid trap diode. The design, fabrication and thermal testing of these heat pipes is described. The demonstrated heat pipe behavior including start-up, forward mode transport, recovery after evaporator dry-out, diode performance and variable conductance control are discussed. F.O.S.

N79-30500# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
TURBULENT BOUNDARY LAYERS. PART 3: ENTRAINMENT APPROACH
M. R. Head (Cambridge Univ., Engl.) Mar. 1968 217 p refs Lecture held at Rhode-Saint-Genese, Belgium, 4-15 Mar. 1968 (VKI-Lecture-Series-5-Pt-3) Avail: NTIS HC A10/MF A01

A lecture series is presented which discusses the following topics: (1) importance of entrainment as a physical phenomenon; (2) turbulence structure and entrainment; (3) original entrainment method for the calculation of form parameter development; (4) the work of Thompson; (5) extension of entrainment method to three-dimensional boundary layers; (6) extension of entrainment to cases involving suction and injection; (7) calculation of heat transfer in constant property turbulent boundary layer; and (8) calculation of compressible turbulent boundary layer. For individual titles, see N79-30501 through N79-30508.

N79-30501# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
IMPORTANCE OF ENTRAINMENT AS A PHYSICAL PHENOMENON
In its Turbulent Boundary Layers, Pt. 3 Mar. 1968 13 p refs (For primary document see N79-30500 21-34)
Avail: NTIS HC A10/MF A01

A general overview of various physical situations in which entrainment plays an important role is presented. Brief discussions are given for the following cases where the concept of entrainment proved helpful in giving physical understanding of the flow: (1) flow over a step; (2) flow through orifices in series; (3) separation bubbles; (4) two-dimensional jet issuing from the top of a step; (5) extension of jet analysis to other cases; (6) oscillations of a bank of cylinders; and (7) buoyant plumes. Flow diagrams and graphs are presented to illustrate the cases. G.Y.

N79-30502# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
TURBULENCE STRUCTURE AND ENTRAINMENT
In its Turbulent Boundary Layers, Pt. 3 Mar. 1968 13 p refs (For primary document see N79-30500 21-34)
Avail: NTIS HC A10/MF A01

It might be reasonably expected that turbulent entrainment should be Reynolds number dependent, and some explanation is required as to why it is not. This question and some other questions relating to turbulent entrainment are answered and an attempt is made to arrive at some sort of coherent physical picture of the structure of turbulent flows. Attention is focused primarily on boundary layers, but almost all of the discussion is equally relevant to turbulent shear flow in general. The following topics are discussed: (1) vorticity; (2) the nature of turbulence; (3) intermittency; (4) flow visualization; (5) effect of pressure gradient on the intermittency distribution in the outer part of the boundary layer; (6) negative entrainment; (7) the spread of heat and momentum; and (8) the nature of the entrainment process. G.Y.

N79-30503# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
ORIGINAL ENTRAINMENT METHOD FOR THE CALCULATION OF FORM-PARAMETER DEVELOPMENT
In its Turbulent Boundary Layers, Pt. 3 Mar. 1968 11 p refs
(For primary document see N79-30500 21-34)
Avail: NTIS HC A10/MF A01

Improvements to an entrainment method, previously developed for the calculation of form-parameter development are discussed. The method in its original form is presented and is followed by a brief discussion of entrainment in wakes and jets. G.Y.

N79-30504# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
THE WORK OF THOMPSON
In its Turbulent Boundary Layers, Pt. 3 Mar. 1968 11 p refs
(For primary document see N79-30500 21-34)
Avail: NTIS HC A10/MF A01

A previous method of calculating turbulent boundary layer development made use of a momentum integral equation, a simple entrainment equation and a skin friction law. Thompson constructed charts, family profiles which used incidentally give a skin friction law that could replace the previous law. As well as surveying calculation methods, Thompson also compared them on the basis of a generalized form of the auxiliary equation. He revised virtually the whole basis of the entrainment equation and introduced an additional term which brought in the rate of change of form parameter. Allowances were also made for the effect of surface curvature and crossflow. The net result of these modifications was improved agreement with experiments. These contributions of Thompson are considered in detail. G.Y.

N79-30505# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
EXTENSION OF ENTRAINMENT METHOD TO THREE-DIMENSIONAL BOUNDARY LAYERS
In its Turbulent Boundary Layers, Pt. 3 Mar. 1968 13 p refs
(For primary document see N79-30500 21-34)
Avail: NTIS HC A10/MF A01

It is rare that boundary layers are accurately two-dimensional. Therefore, there is a need for methods of predicting the development of three-dimensional turbulent boundary layers. It was recognized that the original entrainment method could be readily adapted to three-dimensions. It was considered worth while to undertake a series of calculations for relatively simple three-dimensional situations, which would give some insight into the problems involved and perhaps provide answers of practical utility. Several cases were treated and the results are discussed. The characteristics of three-dimensional boundary layers, the basic equations and the assumptions are also discussed. The cases treated include the following: (1) flow over the rear of an infinite swept wing; (2) attachment line flow on an infinite swept wing; (3) flow on a rotating disc; (4) flow in a vortex diffuser; (5) flow over a rotating cylinder with its axis aligned with the stream; and (6) flow on a rotating forebody. G.Y.

N79-30506# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
EXTENSION OF ENTRAINMENT METHOD TO CASES INVOLVING SUCTION AND INJECTION
In its Turbulent Boundary Layers, Pt. 3 Mar. 1968 11 p refs
(For primary document see N79-30500 21-34)
Avail: NTIS HC A10/MF A01

From 1946 onwards there was a keen interest in the use of boundary layer control, first of all to maintain laminar flow by means of suction and, more recently, to prevent turbulent boundary layer separation by the same means. Considerable interest also evolved in the use of injection as a means of reducing heat transfer. An integral method was developed for calculating the development of the two-dimensional laminar boundary with suction. It was based on the use of a two-parameter family of velocity profiles. The following topics are discussed: (1) requirements of calculation methods for suction or blowing; (2) the law of the wall with suction or injection; (3) velocity profile family with injection; (4) velocity profile family with suction; (5) comparison of skin friction laws; and (6) comparisons with experiments. G.Y.

N79-30507# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
CALCULATION OF HEAT TRANSFER IN CONSTANT PROPERTY TURBULENT BOUNDARY LAYER
In its Turbulent Boundary Layers, Pt. 3 Mar. 1968 11 p refs
(For primary document see N79-30500 21-34)
Avail: NTIS HC A10/MF A01

The method was designed to enable the development of the thermal boundary layer to be calculated for arbitrary distributions of surface temperature, external stream velocity and injection of free-stream fluid at the wall. Temperature profiles and heat transfer rates at the wall are obtained in the course of the calculations. The method is based upon the premise that, once the development of the velocity boundary layer is adequately specified, the heat transfer equation can be solved directly by making a suitable assumption for turbulent Prandtl number. G.Y.

N79-30508# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
CALCULATION OF COMPRESSIBLE TURBULENT BOUNDARY LAYERS
In its Turbulent Boundary Layers, Pt. 3 Mar. 1968 10 p refs
(For primary document see N79-30500 21-34)
Avail: NTIS HC A10/MF A01

The calculation of turbulent boundary layers at high Mach numbers is addressed. The original entrainment method was extended to take compressibility into account. G.Y.

N79-30509# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
TURBULENT BOUNDARY LAYERS. PART 4: HEAT AND MASS TRANSFER IN TURBULENT BOUNDARY LAYERS
F. C. Lockwood (Imperial Coll., London) Mar. 1968 73 p
Lecture held at Rhode-Saint-Genese, Belgium, 4-15 Mar. 1968
(VKI-Lecture-Series-5-Pt-4) Avail: NTIS HC A04/MF A01

A general method of predicting the transfer rates of heat, mass, and momentum in two dimensional, steady, turbulent boundary layers is discussed. The boundary layer equations and the flux laws are presented with examples of boundary layer problems using finite difference methods and partial differential equations. Special practices adopted near wall boundaries are described. A.W.H.

N79-30510# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
MECHANICS OF BOUNDARY LAYER TRANSITION. PART 1: GENERAL INTRODUCTION
Bryan Richards Jan. 1968 22 p refs Lecture held at Rhode-Saint-Genese, Belgium, 15-19 Jan. 1968
(VKI-Lecture-Series-3-Pt-1) Avail: NTIS HC A02/MF A01

The fundamental mechanisms in the transition from laminar to turbulent flow are discussed. The role of transition flow processes improving positional prediction procedures and for determining methods of advancing or retarding the transition position are illustrated. A.W.H.

N79-30511# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
MECHANICS OF BOUNDARY LAYER TRANSITION. PART 4: STABILITY AND COMPLIANT SURFACES
Bryan Richards Jan. 1968 27 p refs Lecture held at Rhodes-Saint-Genese, Belgium, 15-19 Jan. 1968

(VKI-Lecture-Series-3-Pt-4) Avail: NTIS HC A03/MF A01

The application of the theory that the dynamic properties of a boundary layer, and hence, its stability and transition characteristics may be influenced by coupling it hydroelastically to a compliant wall is discussed. Drag reduction methods and the effects of a flexible boundary on hydrodynamic stability are emphasized. A.W.H.

N79-30512*# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

MECHANICS OF BOUNDARY LAYER TRANSITION. PART 5: BOUNDARY LAYER STABILITY THEORY IN INCOMPRESSIBLE AND COMPRESSIBLE FLOW

Leslie M. Mack (JPL) Dec. 1967 252 p refs Lecture held at Rhodes-Saint-Genese, Belgium, 15-19 Jan. 1968

(Contract NAS7-100)

(NASA-CR-162112; VKI-Lecture-Series-3-Pt-5) Avail: NTIS HC A12/MF A01 CSCL 20D

The fundamentals of stability theory, its chief results, and the physical mechanisms at work are presented. The stability theory of the laminar boundary determines whether a small disturbance introduced into the boundary layer will amplify or damp. If the disturbance damps, the boundary layer remains laminar. If the disturbance amplifies, and by a sufficient amount, then transition to turbulence eventually takes place. The stability theory establishes those states of the boundary layer which are most likely to lead to transition, identifys those frequencies which are the most dangerous, and indicates how the external parameters can best be changed to avoid transition. A.W.H.

N79-30513*# Wichita State Univ., Kans. Dept. of Mechanical Engineering.

NUMERICAL MODELING OF TWO-DIMENSIONAL CONFINED FLOWS

Mahesh S. Greywall Aug. 1979 103 p refs

(Grant NsG-3186)

(NASA-CR-162115; ME-MG79-1) Avail: NTIS HC A06/MF A01 CSCL 20D

A numerical model of two-dimensional confined flows is presented. The flow in the duct is partitioned into finite streams. The difference equations are then obtained by applying conservation principles directly to the individual streams. A listing of a computer code based on this approach in FORTRAN 4 language is presented. The code computes two dimensional compressible turbulent flows in ducts when the duct area along the flow is specified and the pressure gradient is unknown. A.W.H.

N79-30514*# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering and Applied Mechanics.

A CALCULATION PROCEDURE FOR VISCOUS FLOW IN TURBOMACHINES. VOLUME 1

I. Khalil and W. Tabakoff Jul. 1979 97 p refs

(Contract NAS3-21609; DA Proj. 1L1-61102-AH-45)

(NASA-CR-159635) Avail: NTIS HC A05/MF A01 CSCL 20D

A method for analyzing the nonadiabatic viscous flow through turbomachine rotors is presented. The field analysis is based upon the numerical integration of the full incompressible stream function vorticity form of the Navier-Stokes equations, together with the energy equation, over the rotor blade-to-blade stream channels. The numerical code used to solve the governing equations employs a nonorthogonal boundary fitted coordinate system that suits the most complicated blade geometries. A numerical scheme is used to carry out the necessary integration of the elliptic governing equations. The flow characteristics within the rotor of a radial inflow turbine are investigated over a wide range of operating conditions. The calculated results are compared to existing experimental data. The flow in a radial compressor is analyzed in order to study the behavior of viscous flow in diffusing cascades. The results are compared qualitatively to known experimental trends. The solution obtained provides insight into the flow phenomena in this type of turbomachine. It is concluded that the method of analysis is quite general and gives a good representation of the actual flow behavior within turbomachine passages. K.L.

N79-30515*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

APPLICATION OF THE PRINCIPLE OF SIMILARITY FLUID MECHANICS

R. C. Hendericks and J. V. Sengers (Md. Univ., College Park) 1979 49 p refs

(NASA-TM-79258; E-170) Avail: NTIS HC A03/MF A01 CSCL 20D

The principle of similarity applied to fluid mechanics is described and illustrated. The concept of transforming the conservation equations by combining similarity principles for thermophysical properties with those for fluid flow is examined. The usefulness of the procedure is illustrated by applying such a transformation to calculate two phase critical mass flow through a nozzle. A.W.H.

N79-30516*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

DESCRIPTION AND ORBIT DATA OF VARIABLE-CONDUCTANCE HEAT-PIPE SYSTEM FOR THE COMMUNICATIONS TECHNOLOGY SATELLITE

Louis Gedeon Aug. 1979 23 p refs

(NASA-TP-1465; E-9880) Avail: NTIS HC A02/MF A01 CSCL 20D

A variable-conductance heat-pipe system (VCHPS) with methanol as the working fluid and a nitrogen and helium mixture as the control gas was used for the thermal control of a 200 W RF traveling wave tube of the Communication Technology Satellite. Three stainless steel heat pipes (one redundant) and an aluminum radiator were designed to transfer 196 watts for an evaporator temperature of 50 C. The system has operated for three years with no noticeable change in performance. On four occasions the heat pipes apparently deprimed. A short time after reducing the tube power, the heat pipes reprimed and the system continued to operate normally. The description, qualification testing, and orbit data of the VCHPS are presented. K.L.

N79-30517# Los Alamos Scientific Lab., N. Mex.

APACHE: A GENERALIZED-MESH EULERIAN COMPUTER CODE FOR MULTICOMPONENT CHEMICALLY REACTIVE FLUID FLOW

J. D. Ramshaw and J. K. Dukowicz Jan. 1979 206 p refs Sponsored in part by the Air Force

(Contract W-7405-eng-36)

(LA-7427) Avail: NTIS HC A10/MF A01

A time-marching finite-difference code that can be run in a purely explicit mode or a partially implicit mode was developed. The governing equations are written in two-dimensional variable-depth form. This description includes planar and cylindrical geometries as special cases. Spatial differences are written in conservative form wherever possible, using a generalized two-dimensional Eulerian mesh that allows convenient representation of curved boundaries and provides variable zoning. A difference approximation to the convective terms, the tensor viscosity method, is used to achieve numerical stability without excessive numerical damping. Multicomponent diffusion is calculated by a self-consistent effective binary diffusion algorithm. APACHE contains a spatial marching option that greatly reduces computer time for steady-state supersonic flow calculations. For CW chemical laser applications, radiation intensities and laser power are calculated. The radiation intensities are fully coupled to the fluid, so that threshold, cutoff, and J-shifting occur automatically. Complete descriptions of the APACHE methodology, the code structure, and the procedure for setting up problems are provided. A FORTRAN listing of the code is included. A.R.H.

N79-30518*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

THE USE OF COMPUTER-GENERATED COLOR GRAPHIC IMAGES FOR TRANSIENT THERMAL ANALYSIS

C. L. W. Edwards, Frances T. Meissner, and James B. Hall Jul. 1979 47 p

(NASA-TP-1455; L-12779) Avail: NTIS HC A03/MF A01 CSCL 20D

Color computer graphics techniques were investigated as a means of rapidly scanning and interpreting large sets of transient heating data. The data presented were generated to support the conceptual design of a heat-sink thermal protection system (TPS) for a hypersonic research airplane. Color-coded vector and raster displays of the numerical geometry used in the heating

calculations were employed to analyze skin thicknesses and surface temperatures of the heat-sink TPS under a variety of trajectory flight profiles. Both vector and raster displays proved to be effective means for rapidly identifying heat-sink mass concentrations, regions of high heating, and potentially adverse thermal gradients. The color-coded (raster) surface displays are a very efficient means for displaying surface-temperature and heating histories, and thereby the more stringent design requirements can quickly be identified. The related hardware and software developments required to implement both the vector and the raster displays for this application are also discussed. Author

N79-30519# Texas Inst. for Computational Mechanics, Austin.
ADAPTIVE REFINEMENT AND NONLINEAR FLUID PROBLEMS
Graham F. Carey May 1979 44 p refs Presented at the Intern. Conf. on Finite Elements in Nonlinear Mech., ISD, Stuttgart, Sep. 1978 Submitted for publication
(Contract N00014-78-C-0550)
(AD-A069830; TICOM-79-3) Avail: NTIS HC A03/MF A01 CSCL 20/4

The research activity deals with theory and implementation of adaptive mesh refinement for finite element analysis of linear and nonlinear problems in mechanics. The theoretical ideas are based upon the use of residuals from the equilibrium equation and associated error bounds which relate the error in the solution to these residuals. The techniques are equally applicable to finite element applications in fluid and solid mechanics. The strategy of interweaving Newton iteration and adaptive refinement appears particularly effective for the nonlinear problems examined. GRA

N79-30520# Pennsylvania State Univ., University Park. Applied Research Lab.
AN INVESTIGATION OF A TWO-PHASE, MOVING BOUNDARY SYSTEM, WITH CONVECTION AT THE SOLID-LIQUID INTERFACE M.S. Thesis
Mark Wayne Nansteel 23 Jan. 1979 144 p refs
(Contract N00024-79-C-6043)
(AD-A069624; ARL/PSU/TM-79-32) Avail: NTIS HC A07/MF A01 CSCL 20/13

An analytical and experimental study has been carried out in order to investigate the behavior of a two-phase, solid-liquid system in which the solid phase is subjected to varying heat flux and temperature at its boundaries. The specific geometry chosen for the study was that of a thin solid layer formation on a planar surface which is maintained below the fusion temperature of the liquid. The determination of the phase boundary position was accomplished primarily by a variable nodal system finite difference technique. In addition, an integral solution similar to those frequently used in the calculation of two-dimensional boundary layer flows in fluid dynamics is formulated and compared with the results of the finite difference technique. It is concluded that the integral solution is in many instances as effective a solution technique as the finite difference method. An experimental study was carried out with ice and water in turbulent channel flow in order to test the validity of the mathematical model. The results of the experiment indicate that the model is capable of predicting the position of the phase interface to within limits of accuracy which are acceptable for most engineering applications. It is found that the model's inability to account for temperature dependent solid phase properties may have an adverse effect on its performance for substances whose transport properties are highly dependent upon temperature. GRA

N79-30521# New Mexico Univ., Albuquerque. Civil Engineering Research Facility.
LAGRANGIAN CALCULATION OF A HIGH EXPLOSIVE DETONATION OVER WATER Final Report, 9 May 1978 9 Apr. 1979
David K. Rudeen Apr. 1979 29 p refs
(Contract N60921-78-C-0064; B0003001)
(AD-A069737) Avail: NTIS HC A03/MF A01 CSCL 20/1

Calculations of a propagating water shock wave resulting from a high explosive detonation air, above the surface of the water is a difficult problem for a Lagrangian wave propagation code to handle accurately due to the resulting severe mesh distortions. This report documents a successful attempt at calculating this problem using the two-dimensional Lagrangian wave propagation code TOODY 2 and its associated rezoning code TOOREZ. GRA

N79-30522# Argonne National Lab., Ill.
FLOW-INDUCED VIBRATION IN SHELL-AND-TUBE HEAT EXCHANGERS FOR OCEAN THERMAL ENERGY CONVERSION (OTEC)
J. J. Lorenz and D. Yung Aug. 1978 49 p refs
(Contract EY-76-C-02-0016)
(ANL-OTEC-78-3) Avail: NTIS HC A03/MF A01

The problem of crossflow-induced vibration in shell-and-tube heat exchangers for OTEC was considered. Models of the dominant excitation mechanisms are discussed: vortex shedding, turbulent buffeting, fluid-eleastic instability, and acoustic excitation. Criteria are presented for assessing vibration and equations are derived for predicting the maximum allowable span length as a function of crossflow velocity and other system variables. Also regions of acoustic resonance and noise are defined. Among the system variables studied are tube diameter, tube material, tube-field layout, and pitch to diameter ratio. All models are presented in a simple form that can readily be applied to the mechanical design of OTEC heat exchangers. DOE

N79-30523# Iowa State Univ. of Science and Technology, Ames.
DROP SEPARATION BY NUMERICAL SOLUTION OF THE NAVIER-STOKES EQUATION Ph.D. Thesis
Dale Alan Fitzgibbons 1978 148 p refs
(Contract W-7405-eng-82)
(IS-T-838) Avail: NTIS HC A07/MF A01

A numerical model of separating drop behavior was constructed and tested by simulation, on a general purpose digital computer, of a hypothetical two-immiscible-phase system. The model uses the Marker-and-Cell (MAC) method to solve the unsteady state Navier-Stokes (momentum balance) equation with incompressible flow. Input to the model consists of fluid parameters, initial conditions, and forcing functions. Simulation results consist of time-varying velocity and pressure fields, and all transformations of the interface profile. The simulation incorporates a one-parameter model of the interface, with the parameter being the equilibrium interfacial tension. At each computational time frame the curvature of the interface is computed by numerically fitting a set of cubic splines to the coordinates of the particles which compose the interface. This curvature is used to compute the pressure drop across the phase boundary, and comprises the boundary condition for the calculation of pressures within the drop. DOE

N79-30524# European Space Agency, Paris (France).
NUMERICAL SOLUTION OF HYPERBOLIC SYSTEMS. APPLICATION TO GAS DYNAMICS
Roger Peyret May 1979 153 p refs Transl. into ENGLISH of 'Resolution Numerique des Systemes Hyperboliques. Application a la Dynamique des Gaz', ONERA, Paris Report ONERA-NT-1977-5, 1978
(ESA-TT-546; ONERA-P-1977-5) Avail: NTIS HC A08/MF A01

Numerical solutions of the initial value problems associated with linear or nonlinear hyperbolic systems, with application to the equations of one-dimensional unsteady gas dynamics, are studied. After recalling the bases of finite difference scheme theory for the solution of linear time-dependent equations, the concept of the equivalent system (the discretization of the system of equations by the scheme to an order of accuracy higher than that to which the original system is subjected) is introduced and some results in the linear case are presented, mainly consisting of stability theorems. The following chapters deal essentially with nonlinear problems and, in particular, the ability of the difference schemes to calculate discontinuous solutions (shock-capturing methods) is investigated. The general class of 3-point, second order accurate, predictor-corrector schemes is considered. Investigation of the dispersive and dissipative properties of these schemes, based on an analysis of the equivalent system, makes it possible to explain and predict the character of the numerical results, in particular the spurious oscillation phenomena.
Author (ESA)

N79-30525# Ruhr Univ., Bochum (West Germany). Inst. fuer Thermo- und Fluiddynamik.

SMOOTH SHEAR LAYERS WITH A DISTURBED TURBULENCE STRUCTURE [EBENE SCHERSCHICTEN MIT GESTOETER TURBULENZSTRUKTUR]

V. Vasantaram Bonn Bundesminn. der Verteidigung Jul. 1978 81 p refs In GERMAN; ENGLISH summary

(BMVG-FBWT-78-13) Avail: NTIS HC A05/MF A01; Bundesmin. der Vertdidigung, Bonn DM 30

After a brief phenomenological description of the causes and effects of the disturbance to the turbulence structure, the concept of relaxation is defined. Attempts made hitherto to describe this shear layer mathematically are reviewed. Experimental work on the shear layer with a disturbed turbulence structure is reported on. The experiments shed light on some essential physical characteristics in this flow, such as the appearance of different relaxation lengths for the various flow quantities pressure, mean velocity, and Reynolds stresses. An attempt is made to explain this feature through a theoretical framework. In the ensuing discussion the state of the art of computation of these shear layers is assessed and directions for further work are pointed out. Author (ESA)

N79-30526# European Space Agency, Paris (France).

DEVELOPMENT OF THE LASER TWO-FOCUS METHOD FOR NON-INTRUSIVE MEASUREMENT OF FLOW VECTORS PARTICULARLY IN TURBOMACHINES Ph.D. Thesis - Technische Hochschule, Aachen

Richard Schodl Mar. 1979 134 p refs Transl. into ENGLISH of 'Entwicklung des laser-Zwei-Fokus-Verfahrens fuer die beruehrungslose messung der stroemungsvektoren, insbesondere in Turbomaschinen', Rept. DLR-FB-77-65 DFVLR, Cologne, Feb. 1978 Supersedes X79-76951 Original German report available from DFVLR, Cologne DM 54,70

(ESA-TT-528; DLR-FB-77-65) Avail: NTIS HC A07/MF A01

The laser Doppler and the laser time-of-flight method are compared for applicability to optical measurement of velocities in turbomachines, more particularly in rotors. It is found that the time-of-flight method is basically superior. A description is given of a laser two-focus method developed on this principle, whereby the original restriction of the time-of-flight method to liw-turbulence flow is lifted, so that all mean flow values defined in the plane perpendicular to the optical axis can now be measured, even in very turbulent flows. This is followed by an exhaustive analysis of errors, with advice for correcting them. Next, a report is given on testing the laser two-focus device in wind tunnels and on research on turbocompressors which have become possible only after the development of auxiliary devices, e.g. for window cleaning, seeding, and laser beam strobing. Finally, selected data on rotor flow in radial and axial compressors are presented and discussed. Author (ESA)

N79-30527# Fraunhofer-Gesellschaft, Stuttgart (West Germany). Inst. fuer Grenzflaechen- und Bioverfahrenstechnik.

A SURVEY ON THE INFLUENCE OF BOUNDARY SURFACE FORCES ON THE BOUNDARIES OF LIQUID PHASES DURING LIQUID TRANSPORT PROCESSES IN A ZERO-g ENVIRONMENT Final Report

Wolfgang Leiner, Bernd Schlindler, and Peter-Juergen Sell Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1977 112 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-576)

(Contract BMFT-WRT-1074; DFVLR-BPT-01-EO-494)

(BMFT-FB-W-77-19) Avail: NTIS HC A06/MF A01; ZLDI, Munich DM 23,10

A survey of the literature on boundary surface forces and their effects on liquid transport processes is presented as an aid in planning zero-gravity experiments in space. Besides the basis of the physics of boundary surfaces, special phenomena of wetting, contact angle, spreading, immersion, sinter processes, zone melting and coalescence are discussed. It is shown liquid flow phenomena at two phase boundary surfaces can be caused by gradients of the boundary surface energy and how at three phase lines flow is caused by the boundary surface forces themselves. These forces are therefore not only important in the case of dispersive systems, but also in the case of multiphase phenomena. Author (ESA)

N79-30528# Technische Universitaet, Hanover (West Germany). Inst. fuer Stroemungsmaschinen.

FLOW PHENOMENA IN ZONE MELTING UNDER ZERO-g CONDITIONS AND IN THE PRESENCE OF AN ELECTROMAGNETIC FIELD Final Report

Chung-Hwang Chun Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1977 72 p refs In GERMAN; ENGLISH summary Report will be also announced as translation (ESA-TT-592)

(Contracts BMFT-WRT-1075; DFVLR-BPT-01-QV-195)

(BMFT-FB-W-77-42) Avail: NTIS HC A04/MF A01; ZLDI, Munich DM 14,70

Convection in zone melting, caused by the gradient of surface tension under zero-gravity conditions, was studied numerically in order to develop a model of the influence of this process on crystal growth. One way to effect this flow phenomenon is by the application of electromagnetic fields. An analysis of the significant forces was used to characterize the melting flow, during the cylindrical zone melting of silicon, with regard to the efficiency of the electromagnetic forces. From the results the temperature and velocity fields, with and without the magnetic field, can be predicted and compared. This provides a basis for the systematic study of the optimal flow and temperature conditions for crystal growth. Author (ESA)

N79-30529# European Space Agency, Paris (France).

DEVELOPMENT OF ULTRASONIC TRANSDUCERS FOR MEASURING LIQUID FLOW RATES AT HIGH TEMPERATURE AND HIGH PRESSURE

Alain Deom Jun. 1979 110 p refs Transl. into ENGLISH of 'Developpement de Capteurs Ultrasonores pour la Mesure de Debits de Liquides a Haute Temperature et Haute Pression', ONERA, Paris Report ONERA-NT-1977-7, 1977

(ESA-TT-562; ONERA-NT-1977-7) Avail: NTIS HC A06/MF A01

Ultrasonic flowmeters developed at ONERA within the framework of studies on the pogo effect in liquid propellant rocket engines permit the measurement of propellant flowrates, with a 200 Hz passband and an accuracy of 1% at pressures up to 30 bar and temperatures from - 180 C to + 80 C. These devices, now industrially available, are in use in Europe, the U.S. and Japan. The extension of this kind of instrument to the conditions of temperature and pressure encountered in nuclear engineering has required fundamental changes in the design of the ultrasonic probes. During the numerous technological studies which are presented several solutions were tried, of which two appear satisfactory. Theoretical difficulties arising from temperature gradients in the duct have also had to be overcome. The transducers were tested in water up to 300 C and 200 bar; an accuracy of the order of 1% has been obtained up to 200 Hz. Author (ESA)

N79-30530# European Space Agency, Paris (France).

OPTICAL MEASUREMENTS IN FLOW. APPLICATIONS TO WIND TUNNELS AND ENGINE TEST STANDS

Xavier Bouis Jun. 1979 55 p refs Transl. into ENGLISH of 'Mesures Optiques dans les Ecoulements. Applications aux Soufflerles ou aux Bancs d'Essais de Moteurs', ONERA, Paris Report ONERA-NT-1978-5, 1978

(ESA-TT-563; ONERA-NT-1978-5) Avail: NTIS HC A04/MF A01

Optical measurements in wind tunnels are reviewed. The methods used in wind tunnels are either integral (interferometry, selective absorption) or local, based on light diffusion by tracers (laser velocimetry) or by the gas itself (Raman, Rayleigh, fluorescence). All, or most of them, have been successfully used in research laboratories, but their use usually meets with difficulties, such as intricate optical access, vibration of pollution, spurious light, prohibitive measurement or processing durations, lengthy change of measuring point. Thus, doubts may appear as regards the data actually measured. Some of these optical methods, which complement standard techniques, are too complex or not sensitive enough to be of practical use, but others, such as holographic interferometry, Raman effect in hot flows and the various forms of laser velocimetry are commonly used. Their implementation requires a mechanical and optical adaptation, sometimes modification of the data acquisition system of the facility, and always a minimum of training for the personnel. Author (ESA)

N79-30531# Idaho National Engineering Lab., Idaho Falls.
THE MEASUREMENT OF PHASE VELOCITIES IN MIST FLOWS USING STAGNATION PROBES
James R. Fincke and Vance A. Deason May 1979 42 p refs
(Contract EY-76-C-07-1570)
(PB-294974/1; TREE-1350; NUREG-CR-0648) Avail: NTIS HC A03/MF A01 CSCL 20D

The development of a new probe which measures the gas stagnation pressure and the total stagnation pressure of a two phase mist flow over a wide range of flow conditions is discussed. Modeling techniques are presented from which the local phase velocities and void fraction may be obtained. GRA

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N79-30532 Colorado School of Mines, Golden.
QUANTITATIVE COMPOSITIONAL MAPPING WITH THE ELECTRON MICROPROBE Ph.D. Thesis
Walrave Theodoor Jansen 1979 287 p
Avail: Univ. Microfilms Order No. 7918479

The standard electron microprobe produces two-dimensional images of elemental distributions by displaying X-ray photon-caused pulses on a cathode ray tube screen as the electron beam scans the sample. The usefulness of the microprobe, diminished by this inaccurate qualitative elemental recording method, increases significantly with quantification of two-dimensionally collected X-ray intensities. Standards, scanned in the same manner as analytes, give a grid of X-ray intensities defining a least-squares fitted surface to compensate for areal defocusing of the spectrometers, and to quantify sample composition. Compositional mapping enhances the probe's sensitivity and utility over conventional use. Dissert. Abstr.

N79-30533*# Honeywell, Inc., Lexington, Mass. Electro-Optics Center.
MODERATE TEMPERATURE DETECTOR DEVELOPMENT Final Report
A. K. Sood, J. W. Marciniec, and M. B. Reine Aug. 1979 142 p refs
(Contract NAS9-15250)
(NASA-CR-160306) Avail: NTIS HC A07/MF A01 CSCL 14B

The development of (Hg, Cd)Te detectors for 8 to 12 micrometer wavelength regions capable of achieving significantly improved sensitivity at noncryogenic temperatures is discussed. M.M.M.

N79-30534*# Honeywell Electro-Optics Center, Lexington, Mass.
DEVELOPMENT OF NINE-CHANNEL 10-MICROMETER (Hg, Cd)Te PUSHBROOM IR/CCD SYSTEM Final Report
W. J. White and S. Wasa Dec. 1977 90 p refs
(Contract NAS5-22339)
(NASA-CR-159933) Avail: NTIS HC A05/MF A01 CSCL 14B

The engineering development of the 9-channel detector array is documented. The development of the array demonstrates the feasibility of a self scanned multi-element infrared detector focal plane. Procedures for operating the array are outlined. R.E.S.

N79-30535# Air Force Academy, Colo.
A SUB-SEISMIC TEST PLATFORM AS A MOTION EXCITER Final Report, Apr. 1978 - Apr. 1979
Bill J. Simmons 1979 14 p refs Presented at the 25th Instrumentation Symp. of the Instr. Soc. of Am. ISA, Anaheim, Calif., 7-10 May 1979
(AF Proj. 2304)
(AD-A069848) Avail: NTIS HC A02/MF A01 CSCL 14/2

The technique and use of a large pneumatically supported test platform as a motion exciter is described. Maximum motion capability, and the effects of system resonances of the 450,000 lb, servo controlled, isolation test platform is shown for use in tests of motion sensors (e.g., inertial navigation gyros and accelerometes, seismometers, and tiltmeters). The possibility of large test specimens, such as a complete navigation system, is considered. Information is provided on the construction of the test platform and the electropneumatic control system which maintains the test platform level to 0.001 arc seconds and free of vibrations greater than 10 to the -8th power g. GRA

N79-30536# Sandia Labs., Albuquerque, N. Mex.
DEVELOPMENT OF THE SEMICONDUCTOR RADIATION DETECTOR
J. M. McKenzie Dec. 1978 51 p refs
(Contract EY-76-C-04-0789)
(SAND-78-1114) Avail: NTIS HC A04/MF A01

The expansion of gold-germanium alpha particle detectors, through such developments as the room temperature heavy particle counters and wider depletion region techniques, to the emergence of germanium gamma semiconductor detectors, and later the fabriction of high purity germanium multidetector arrays is described. DOE

N79-30537# European Space Agency, Paris (France).
MEASURING AND EVALUATION PROGRAMS OF HOT WIRE SIGNALS USING THE TGM 3 TURBULENCE LEVEL METER DEVELOPED BY THE DFVLR
Eberhard Froebel and Jorg-Dieter Vagt Mar. 1979 27 p refs
Transl. into ENGLISH of 'Mess- und Auswerteverfahren von Hitzdrahtsignalen mit dem turbulenzgradmesser TGM 3 der DFVLR', Rept. DLR-FB-77-61 DFVLR, Berlin, Dec. 1977 Supersedes X79-71551 Original German report available from DFVLR, Cologne DM 13,70
(ESA-TT-520; DLR-FB-77-61) Avail: NTIS HC A03/MF A01

An analog instrument, the turbulence-level-meter TGM 3, is presented for the evaluation of hot-wire signals from measurements in turbulent flows. This instrument is a complete unit for the evaluation of different linear and quadratic mean-values and their ratios. Due to the special design as a complete unit, the measuring programs, the accuracies, frequency response, and conversion factors to fluid quantities are fixed. In contrast to evaluation devices which consist of several instruments, there are less difficulties in interpretations and attendance. Furthermore, some fundamentals of the measuring technique are discussed as far as they are important for the programs of the turbulence-level-meter. Author (ESA)

N79-30538# Siemens A.G., Berlin (West Germany). Bereich Elektronemikroskope.
BASIC RESEARCH IN THE FIELD OF ELECTRON MICROSCOPE SPECIMEN PREPARATION TECHNIQUES Final Report
Tonar Klaus and Peter Sieber Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1977 74 p refs In GERMAN; ENGLISH summary
(Contract BMFT-NT-389)
(BMFT-FB-T-77-79) Avail: NTIS HC A04/MF A01; ZLDI, Munich DM 15,10

The resolution limit of today's commercially available high resolution electron microscopes is 0.1 nm. However, the performance depends on the use of a reliable preparation technique. In order to fully exploit the electron microscopes capabilities, methods for the routine fabrication of extremely thin support foils and suitable tests specimens as well as for the quantitative measurement of the support foil contrast were developed. Investigations included tests of different evaporation methods for the preparation of foils and improvement of the method for evaporating on liquid surfaces, development of a method to measure the contrast of thin foil micrographs, determination of the contrast of thin foils versus the foil thickness, fabrication and study of line resolution test specimens for the range 0.07 to 0.3 nm, and selection and synthesis of substances suitable for single atom imaging. The evaporation of glycerin surfaces turned out to be the most suitable for obtaining homogeneous, clear, stable foils down to 1.2 nm in thickness. A method developed for measuring the contrast in micrographs

of amorphous specimens proved aluminum oxide foils to have the least contrast of all investigated films. Author (ESA)

N79-30539# European Space Agency, Paris (France). Inst. fuer Flugfunk und Mikrowellen.

OPTICAL SURVEY OF THE DFVLR RADIO INTERFEROMETER

R. Reiser (Fachhochschule Rheinland-Pfalz) and R. Weppner Feb. 1979 35 p Transl. into ENGLISH of 'Optische Vermessung des Radiointerferometers der DFVLR', DFVLR, Oberpfaffenhofen, West Ger. Report DLR-IB-551-77/13, Nov. 1977 Original report in GERMAN previously announced as ESA-90997
(ESA-TT-483; DLR-IB-551-77/13) Avail: NTIS HC A03/MF A01

The procedures to be adopted for the adjustment measurements, the location measurements, and the permanent survey of a satellite orbit measuring radio interferometer installation are described. During construction both the structural steelwork and the network of pillars (benchmarks) were continually checked. During operation a permanent survey is performed to ascertain deviations from the zero position. Detailed instructions for the survey of the base network, for the adjustment of the rotating antenna support and reflector, and for the zero measurements are included. Author (ESA)

N79-30540# Kentucky Water Resources Research Inst., Lexington.

DESIGN OF A RELIABLE, INEXPENSIVE RECORDING GAGE WHICH UTILIZES SOLID-STATE MEMORY Research Report, Jul. 1977 - Mar. 1979

Stephen A. Dyer 1979 51 p refs
(Contracts DI-14-34-0001-7038; DI-14-34-0001-8019)
(PB-294536/8; RR-119; W79-05793; OWRT-A-072-KY(1))
Avail: NTIS HC A04/MF A01 CSCL 04B

A microprocessor controlled remote recording rain gage which is capable of unattended operation for periods of greater than a month that costs less than $400 in single quantities is described. The laboratory prototype uses a tipping bucket to collect precipitation in 0.01-inch increments. The time of the bucket tip is stored, using an offset binary format, in solid-state memory. A complete description of the gage hardware is presented along with an outline of the software used are discussed. A reliable and cost effective gage is suggested to include a tipping bucket, a CMOS time base, a CMOS version of an 8748-like or 6802-like microprocessor, and a 256 kilobit magnetic bubble memory. GRA

N79-30541# RCA Labs., Princeton, N. J.

HIGH-SPEED SPREADING RESISTANCE PROBE Final Report, 24 Apr. 1975 - 30 Jun. 1976

N. Goldsmith and A. Mayer Mar. 1979 112 p refs
(Grant NBS-5-35914; ARPA Order 2397)
(PB-293490/9; NBS/GCR-79/166) Avail: NTIS HC A06/MF A01 CSCL 14B

The application of the continuous spreading resistance (CSR) measurement concept instead of the point-by-point measurement of SR was shown to be feasible. The continuous spreading resistance probe developed is capable of measuring the SR 5 to 20 times faster than existing commercial probes. Probes made from a tungsten carbide-cobalt alloy were evaluated for use as a CSR probe and can be used for extended periods of time. A digitizer parallel-to-series converter was constructed that forms the basic building block for a computerized data handling system. The data obtained from specially prepared deep-diffused specimens indicate that this may well prove to be a very useful method of rapidly standardizing SR measurement. GRA

N79-30542# National Technical Information Service, Springfield, Va.

HOLOGRAPHIC FLOW VISUALIZATION. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Apr. 1979

Brian Carrigan May 1979 82 p Supersedes NTIS/PS-78/0351; NTIS/PS-77/0332; NTIS/PS-76/0338; NTIS/PS-75/115
(NTIS-PS-79/0453/5; NTIS/PS-78/0351; NTIS/PS-77/0332; NTIS/PS-76/0338; NTIS/PS-75/115) Avail: NTIS HC $28.00/MF $28.00 CSCL 20D

Research covering flow in wind tunnels, gas lasers, aircraft wakes, aircraft engines, supersonic flow, and shock waves is cited. Most of the techniques involve interferometric holography. (This updated bibliography contains 74 abstracts, 1 of which is a new entry to the previous edition.) GRA

N79-30543# National Technical Information Service, Springfield, Va.

HOLOGRAPHIC FLOW VISUALIZATION. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Apr. 1979

Brian Carrigan May 1979 109 p Supersedes NTIS/PS-78/0352; NTIS/PS-77/0333; NTIS/PS-76/0339
(NTIS/PS-79/0454/3; NTIS/PS-78/0352; NTIS/PS-77/0333; NTIS/PS-76/0339) Avail: NTIS HC $28.00/MF $28.00 CSCL 20D

Worldwide research on holographic flow visualization is cited. The studies cover techniques, theory, equipment, and various applications to measure flow in lasers, shock tubes, wind tunnels, and over aerodynamic surfaces. This updated bibliography contains 103 abstracts, 17 of which are new entries to the previous edition. GRA

N79-30544# National Technical Information Service, Springfield, Va.

SCHLIEREN AND SHADOWGRAPH PHOTOGRAPHY. PART 2: GENERAL STUDIES, VOLUME 1. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970-1974

Guy E. Habercom, Jr. Jun. 1979 146 p
(NTIS/PS-79/0504/5) Avail: NTIS HC $28.00/MF $28.00 CSCL 14E

Aspects of Schlieren and shadowgraph photography are covered in this bibliography of worldwide engineering research. Techniques, equipment, and applications are reviewed for studying shock waves, combustion, acoustic waves, ballistics, and heat flow. This updated bibliography contains 141 abstracts. GRA

N79-30545# National Technical Information Service, Springfield, Va.

SCHLIEREN AND SHADOWGRAPH PHOTOGRAPHY. PART 1: FLOW VISUALIZATION AND MEASUREMENT. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Apr. 1979

Guy E. Habercom, Jr. Jun. 1979 227 p Supersedes NTIS/PS-78/0412; NTIS/PS-77/0347; NTIS/PS-76/0336
(NTIS/PS-79/0503/7; NTIS/PS-78/0412; NTIS/PS-77/0347; NTIS/PS-76/0336) Avail: NTIS HC $28.00/MF $28.00 CSCL 14E

Worldwide engineering research of Schlieren and shadowgraph photography techniques for flow measurement and visualization is presented. Included are studies on flames, combustion, and aerodynamic configurations. This updated bibliography contains 221 abstracts. GRA

N79-30546# National Technical Information Service, Springfield, Va.

SCHLIEREN AND SHADOWGRAPH PHOTOGRAPHY, VOLUME 1. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964-1975

Guy E. Habercom, Jr. Jun. 1979 205 p
(NTIS/PS-79/0501/1) Avail: NTIS HC $28.00/MF $28.00 CSCL 14E

The applications and techniques of Schlieren and shadowgraph photography are covered in this bibliography of federally-funded research. The majority of the reports are primarily concerned with flow visualization, although there are included studies on heat transfer and combustion processes. This updated bibliography contains 188 abstracts. GRA

N79-30547# National Technical Information Service, Springfield, Va.

SCHLIEREN AND SHADOWGRAPH PHOTOGRAPHY, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1976 - Apr. 1979

Guy E. Habercom, Jr. Jun. 1979 164 p Supersedes NTIS/PS-78/0411; NTIS/PS-77/0346; NTIS/PS-76/0335; NTIS/PS-75/117
(NTIS/PS-79/0502/9; NTIS/PS-78/0411; NTIS/PS-77/0346; NTIS/PS-76/0335; NTIS/PS-75/117) Avail: NTIS

HC $28.00/MF $28.00 CSCL 14E

Abstracts of papers concerning applications and techniques of Schlieren photography and shadowgraph photography are presented. A majority of the reports are concerned with flow visualization. This bibliography contains 158 abstracts. GRA

N79-30548# National Technical Information Service, Springfield, Va.

SCHLIEREN AND SHADOWGRAPH PHOTOGRAPHY. PART 2: GENERAL STUDIES, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1975 - Apr. 1979

Guy E. Habercom, Jr. Jun. 1979 124 p Supersedes NTIS/PS-78/0413; NTIS/PS-77/0348; NTIS/PS-76/0337 (NTIS/PS-79/0505/2; NTIS/PS-78/0413) Avail: NTIS HC $28.00/MF $28.00 CSCL 14E

Techniques, equipment, and applications are reviewed for studying shock waves, combustion, acoustic waves, ballistics, and heat flow. (This updated bibliography contains 119 abstracts, 33 of which are new entries to the previous edition.) GRA

36 LASERS AND MASERS

Includes parametric amplifiers.

N79-30549# Aerospace Corp., El Segundo, Calif. Aerophysics Lab.

DESALE-5: A COMPREHENSIVE SCHEDULED MIXING MODEL FOR CW CHEMICAL LASERS Interim Report

Melvin Epstein 1 May 1979 46 p refs

(Contract F04701-78-C-0079)

(AD-A069599; TR-0079(4940-01)-3; SAMSO-TR-79-31) Avail: NTIS HC A03/MF A01 CSCL 20/5

The development and application of a comprehensive model for calculating cw chemical laser performance are described. The effects of mixing through the use of a scheduled mass addition algorithm, extensive modeling of the pertinent chemical reactions, Fabry-Perot optics, nozzle blockage, and nonuniform initial profiles resulting from nozzle boundary layers are given. Illustrative examples are provided to demonstrate the capability of the model to treat these various phenomena. A typical running time on a CDC 7600 is 30 to 60 sec with all of the effect modeled. GRA

N79-30550# Avco-Everett Research Lab., Mass.

METAL VAPOR EXCIMER LASER Quarterly Progress Report, 1 Aug. - 31 Oct. 1978

M. A. Kovacs and J. H. Jacob Dec. 1978 24 p refs

(Contract ES-77-C-02-4275)

(COO-4275-6) Avail: NTIS HC A02/MF A01

Progress in the metal vapor excimer program is reported. Initial design considerations for the foil and foil support of a high temperature, transverse e-beam discharge device were generated. In addition, foil material testing was performed. DOE

N79-30551# Texas Univ. at Austin. Center for Electromechanics.

PULSED POWER SUPPLIES FOR LASER FLASHLAMPS Final Report

William L. Bird, Jr., comp., Mircea D. Driga, comp., David J. T. Mayhall, comp., and Michael Brennan, comp. Oct. 1978 144 p refs

(Contract W-7405-eng-48)

(UCRL-13964) Avail: NTIS HC A07/MF A01

A preliminary engineering design of a compensated pulse alternator for driving laser flashlamps is presented. The work performed by the Center for Electromechanics at The University of Texas at Austin also includes the optimization and revision of the prototype design for a compensated pulse alternator power supply for the NOVA laser system at Lawrence Livermore Laboratory. DOE

N79-30552# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Div.

LASER RANGING INSTRUMENTATION Final Report

G. Barthel, T. Halldorsson, H. Hufnagel, D. Meissner, and Ch. Schmidt Paris ESA 20 Dec. 1978 249 p refs

(Contract ESTEC-3458/78/NL-PP(SC))

(MBB-3700/7908-R) Avail: NTIS HC A11/MF A01

A standard laser-radar instrumentation system is defined for multiple space applications such as rendezvous and docking and high resolution phase measurements (long baseline interferometry). The instrument performance covers active acquisition and tracking of targets and the measurements of range and range rate up to ranges of 250 kms with a range resolution of 0.01 m (near field) to 0.1 m (far field), and a range rate resolution of 1/100,000 m/sec. The tracking accuracy is 1 arcsec. The emitters used are a highly stabilized CO2 laser for the range rate measurement and a CW laser diode for range measurement during acquisition and tracking. For angular sensing CCD array is used, the optical path of the transmitter and receiver are coaxial with a cassergrain telescope. The selection of the measurement principles and the instruments layout was based on detailed tradeoffs. Author (ESA)

N79-30253*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Communications Systems Research Section.

AN IMPROVED STORAGE BULB MOUNT FOR DSN HYDROGEN MASERS

P. R. Dachel, D. P. Russell, T. K. Tucker, and L. B. Stratman *In its* The Deep Space Network 15 Aug. 1979 p 21-25 refs (For primary document see N79-30248 21-12)

Avail: NTIS HC A06/MF A01 CSCL 20E

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N79-30553*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

PRESSURE CONTROL VALVE Patent Application

Kenneth H. Lambson, inventor (to NASA) (Lambson, Kenneth H. and Assoc., San Jose, Calif.) Filed 13 Jul. 1979 12 p Sponsored by NASA

(NASA-Case-ARC-11251-1; US-Patent-Appl-SN-057465) Avail: NTIS HC A02/MF A01 CSCL 13K

A control valve is described which is adapted to be connected between a pressure source, such as a vacuum pump, and a pressure vessel to control the pressure in the vessel. The valve comprises a housing having a longitudinal bore which is connected between the pump and vessel, and a transversely movable valve body which controls the air flow through an air inlet in the housing. The valve body includes cylindrical and conical portions which cooperate with reciprocally shaped portions of the housing to provide flow control. A filter disposed in the air inlet filters out foreign matter in the air. The bottom end of the valve body screws into the valve housing control knob which is formed integrally with the valve body and controls opening and closing of the valve. NASA

N79-30554# Naval Research Lab., Washington, D. C.

FORMATION OF PARTICULATE CONTAMINANTS (BROWN SUGAR) IN MINIATURE BEARINGS Interim Report

M. K. Bernett, R. C. Bowers, H. Ravner, and P. J. Sniegoski 31 May 1979 24 p refs

(AD-A069754; NRL-MR-4012) Avail: NTIS HC A02/MF A01 CSCL 13/9

There have occasionally been field reports of miniature bearing failures attributed to particulate contaminants which, because of their appearance under low-power magnification, have been given the descriptive term 'brown sugar'. This study examines the formation of particulates under both dynamic and static conditions. The lubricants include diesters, polyol esters, a silicone, and mineral oil; the bearing surfaces or substrates were 52100 steel, 440 C steel, and Pyrex. Particulate formation was readily achieved under boundary lubrication. The resultant films adhered tenaciously and resisted rinsing or wiping. Surface analysis by X-ray photoelectron spectroscopy and Auger electron spectroscopy indicated the presence of iron oxides and probably iron-organics (soap) compounds. Under static conditions exposure of thin films of lubricants to light or heat (100 C) did not generate lubricant-derived particulate products. This exposure did have one adverse

effect, viz. the complete depletion of several antioxidants after only a few hours. GRA

N79-30555# Timken Co., Canton, Ohio.
TAPERED ROLLER BEARING DEVELOPMENT FOR AIRCRAFT TURBINE ENGINES Final Report, 8 Mar. 1976 - 8 Mar. 1979
Peter S. Orvos and G. J. Pressler Wright-Patterson AFB, Ohio AFAPL Mar. 1979 102 p refs
(Contract F33615-76-C-2019; AF Proj. 3048)
(AD-A069440; AFAPL-TR-79-2007) Avail: NTIS HC A06/MF A01 CSCL 13/9

Finite element methods were used to structurally analyze various potential cage designs for tapered roller bearings operating at 3.5 million DN. The race guided Z design exhibited the greatest strength. Short duration evaluation tests verified these findings. Performance tests were conducted to determine bearing loss characteristics and oil-off survival. Parameters investigated, which influence losses (torque or heat generation), were speed, load, lubricant properties, lubricant flow rate and lubricant distribution. Oil-off survival tests were successfully run at 1.5 and 2.0 million DN. The bearing fatigue life tests conducted at 3 million DN showed a high degree of life scatter. The 90 percent survival level was 2.78 times the unadjusted catalog life expectancy. GRA

N79-30556# Sandia Labs., Albuquerque, N. Mex.
SEAL STUDIES FOR ADVANCED FLYWHEEL SYSTEMS
I. Anwar Mar. 1979 66 p refs
(Contract EY-76-C-04-0789)
(SAND-79-7011) Avail: NTIS HC A04/MF A01

A seal application for an advanced flywheel system where housing pressure (vacuum) is equal to 0.0001 torr was investigated. Many conventional types of seals can be ruled out due to such extreme pressure conditions. The principle of molecular vacuum pumps was examined. It is believed that a flywheel seal system based upon moleular vacuum pump principles on the vacuum side and upon viscous flow principles on the high-pressure side, can be developed. DOE

N79-30557# Sandia Labs., Albuquerque, N. Mex.
DEVELOPMENT OF AN ADVANCED FLYWHEEL BEARING PERFORMANCE MODEL Final Report
D. B. Eisenhaure and E. P. Kingsbury Oct. 1978 50 p refs
(Contract EY-76-C-04-0789)
(SAND-79-7003) Avail: NTIS HC A03/MF A01

Work on the analysis and test of ball bearings suitable for vehicular flywheel applications is summarized. Particular emphasis was placed on the full complement retainerless concept, for which prior research indicated low losses and long life at high speeds in a vacuum environment. Experimental friction losses measured in retainerless bearings for a variety of loads, sizes, and speeds were combined with detailed theoretical loss model calculations to produce a loss prediction model in a form suitable for use by a designer. DOE

N79-30558# California Univ., Livermore. Lawrence Livermore Lab.
AUTOMOTIVE ENGINE MODELING WITH A HYBRID RANDOM CHOICE METHOD
Gary A. Sod, (North Carolina State Univ., Raleigh) Nov. 1978 35 p refs Presented at 1979 SAE Congr. and Exposition, Engine Modeling Session, Detroit, 26 Feb. - 2 Mar. 1979
(Contract W-7405-eng-48)
(UCRL-81979; Conf-790216-1) Avail: NTIS HC A03/MF A01

A numerical procedure was introduced for solving one dimensional equations of gas dynamics for a cylindrically or spherically symmetric flow. This method was generalized to the two dimensional equations of gas dynamics in a cylindrical geometry. This was coupled at the boundary with a grid free method (where the computational elements are segments of vortex sheets) for approximating boundary layers on a flat plate and in a cylinder. Examples are given for flow in a motored engine chamber during intake and compression stokes. DOE

N79-30559# Sandia Labs., Albuquerque, N. Mex.
ENGINE CONTROLLER
J. Akins Apr. 1979 42 p
(Contract EY-76-C-04-0789)
(SAND-79-8008) Avail: NTIS HC A03/MF A01

The engine controller is the controlling interface between an internal combustion engine, the engine control functions, and the diagnostic equipment in a Raman experiment. The controller triggers the ignition and fuel injection for the engine and provides timing signals to the laser, analog-to-digital converters, and system computer. One engine controller was fabricated and subsequent operations and tests show it to perform as designed. DOE

N79-30560# Brussels Univ. (Belgium). Inst. de Mecanique Appliquee.
GAS BEARINGS, PRINCIPLES, EXAMPLES OF APPLICATIONS, AND A CALCULATION METHOD [PALIERS A GAZ: PRINCIPES, EXAMPLES D'APPLICATION, METHODE DE CALCUL]
Jan Krysinski (Univ. Tech. de Lodz, Poland) 22 Apr. 1978 48 p refs In FRENCH
(NT-42-1978) Avail: NTIS HC A03/MF A01

A theoretical discussion of gas bearings and their applications is presented along with a calculation method for characterizing different types of gas bearings fed by an exterior compressed gas supply. The advantages, such as negligible friction, constant working temperature, and very high rotational speeds, are examined and contrasted to the disadvantages of those bearings, being principally the need for precision machining and the mandatory use of special materials for the bearing surfaces. The calculation method is intended to be a general solution of the equations for gas films (Reynold's equation) and is used to find the pressure distributions as defined by the gas feed rate and extent of bearing surface. Author (ESA)

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N79-30561 British Library Lending Div., Boston Spa (England).
VIBRATORY AND ACOUSTICAL SOUNDING OF MACHINE PARTS
G. Sapy 7 Dec. 1978 9 p refs Transl. into ENGLISH of French conf. paper, 5B-7 Presented at the 9th World Conf. on Nondestructive Testing 9 p
(BLL-Risley-TR-4019-(9091.9F)) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.

Vibratory and acoustical techniques can be used as nondestructive tests of the structural and functional integrity of machine parts during running or when stopped, without any dismantling. Examples of the application of these techniques presented include: (1) testing the frictional properties of surfaces by vibrational detection of the start of seizing; (2) determining internal tightness by vibro-acoustic detection of the noise from leaks; (3) testing the solidity of mechanical parts of an assembly by vibratory detection of play; and (4) checking the mechanical quality of parts by vibratory or acoustic detection of cracks. A.R.H.

N79-30562 British Library Lending Div., Boston Spa (England).
PRACTICAL EXPERIENCE WITH ULTRASONIC TESTING OF PLANE AND CURVED AUSTENITIC COMPONENTS
M. Roemer, T. Just, K. Matthies, B. Kuhlow, and E. Neumann 30 Jan. 1979 15 p refs Transl. into ENGLISH from Proc. of the 1st European Conf. on Non-Destructive Testing (Mainz), 1978 p 361-370 Presented at the 1st European Conf. on Non-Destructive Testing, Mainz, 24-26 Apr. 1978
(BLL-Risley-TR-4033-(9091.9F)) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.

The techniques for ultrasonic inspection of austenitic welds are reported. The techniques involved are the transmitting/receiving techniques and the focusing technique. The properties and applications of the transmitting/receiving probes which operate with oblique longitudinal waves are described. A.W.H.

N79-30563 British Library Lending Div., Boston Spa (England).
LOW FREQUENCY ACOUSTIC METHODS OF NONDESTRUCTIVE TESTING
Yu. B. Lange and I. B. Moskovenko 30 Jan. 1979 29 p refs Transl. into ENGLISH from Defektoskopiya (USSR), no. 9, Sep. 1978 p 22-36
(BLL-Risley-TR-4037-(9091.9F)) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.

The basic low frequency acoustic methods of nondestructive testing developed and used mainly in the last 20 years are reviewed with emphasis on their physical principles, their possibilities and areas of application, and the apparatus used. Common to all the methods examined is the use of compression vibrations of sonic and low ultrasonic frequency (usually up to 100-150 kHz) and the dry contact of the emitting and receiving transducers with the item being examined in a zone with a small area, referred to as dry point contact. Microphones are also used to receive compression vibrations. A.R.H.

N79-30564*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A THERMAL VACUUM TEST OPTIMIZATION PROCEDURE
Raymond Kruger and H. P. Norris Jun. 1979 230 p refs Submitted for publication
(NASA-TM-80297) Avail: NTIS HC A11/MF A01 CSCL 14D

An analytical model was developed that can be used to establish certain parameters of a thermal vacuum environmental test program based on an optimization of program costs. This model is in the form of a computer program that interacts with a user insofar as the input of certain parameters. The program provides the user a list of pertinent information regarding an optimized test program and graphs of some of the parameters. The model is a first attempt in this area and includes numerous simplifications. The model appears useful as a general guide and provides a way for extrapolating past performance to future missions. G.Y.

N79-30565# Oak Ridge National Lab., Tenn.
ULTRASONIC CHARACTERIZATION OF AUSTENITIC WELDS
L. Adler, K. V. Cook, and D. W. Fitting 1978 18 p refs Presented at the 1st Symp. on Ultrasonic Mater. Characterization, Gaithersburg, Md., 7 Jun. 1978
(Contract W-7405-eng-26)
(CONF-780650-6) Avail: NTIS HC A02/MF A01

Initial studies were carried out in a type 308 stainless steel electroslag weld to characterize mechanical anisotropy. The apparent symmetry in the macrostructure of the electroslag weld leads us to expect orthotropic symmetry in elastic constants. A technique was developed to measure variations in velocity and attenuation with direction. The velocity data compared favorably to theoretical calculations using this orthotropic model. From the velocity data all elastic constants and engineering constants for this weld were determined. Studies of other types of welds showed that orthotropic symmetry is typical of austenitic welds. Data presented show how anisotropy affects defect location and sizing in welds. DOE

N79-30566# Sandia Labs., Albuquerque, N. Mex. Quality Control Development and Special Projects Div.
MATHEMATICAL TREATMENT OF MEASUREMENT DATA FOR SUPPLANTING THE USE OF AN OPTICAL COMPARATOR IN THE INSPECTION OF MANUFACTURED PARTS
Walter J. Halpin Apr. 1979 57 p ref
(Contract AC-04-76DP00789)
(SAND-78-1787) Avail: NTIS HC A04/MF A01

A mathematical analog to an optical comparator is presented and the computer program MOCO which employs the analog is described. It contains results from application of the program to hypothetical data for typical manufactured parts which prove out the effectiveness of the program. It also contains a study of the inspection of a number of actual manufactured parts of the same type using the MOCO program. The usefulness of MOCO is shown and difficulties that may be encountered during inspection if the accuracies of the measurements involved are not consistent with the tolerances placed on the part features and contours are pointed out. Ways for minimizing the number of computer calculations required are discussed as are means for improving and extending the program, e.g., to three dimensions. DOE

N79-30567# Los Alamos Scientific Lab., N. Mex.
RELSIM: A SYSTEMS RELIABILITY SIMULATION CODE
E. P. Schelonka 1979 9 p refs Presented at Ann. Reliability and Maintainability Symp., Washington, D. C., 23 Jan. 1979
(Contract W-7405-eng-36)
(LA-UR-78-2532; Conf-790116-1) Avail: NTIS HC A02/MF A01

The reliability characteristics of systems with multidimensional networks containing nonidentical digital components in tandem, and parallel with any survivability strategies were modeled with RELSIM program modules. DOE

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N79-30568 British Library Lending Div., Boston Spa (England).
MAXIMUM LOAD BEARING CAPACITY OF STEEL REINFORCED CONCRETE COMPONENTS UNDER IMPACT LOADING
E. Limberger, K. Brandes, and J. Herter 7 Dec. 1978 13 p refs Transl. into ENGLISH from West German article, Grenztragfaehigkeit von Stahlbetonbauteilen unter Stossbelastung, 1977 p 149-152
(BLL-Risley-TR-4036-(9091.9F)) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.

The strain behavior of a steel reinforced concrete component under static and dynamic loads is studied. A servo-hydraulic impact apparatus was employed for impact loading tests. This provided data of the mechanical behavior of the reinforced concrete components up to their maximum load bearing capacity. The energy absorption capacity of the reinforced components are examined and compared to strain rates. A.W.H.

N79-30569 Virginia Univ., Charlottesville.
TRANSIENT ANALYSIS OF STRUCTURAL MEMBERS BY THE CSDT RICCATI TRANSFER Ph.D. Thesis
Fei-Hon Chu 1978 96 p
Avail: Univ. Microfilms Order No. 7916334

A method for direct integration of dynamic equations of motion of structural members is developed. This technique is called the Continuous-Space Discrete-Time (DSDT) Riccati Transfer Matrix Method. This formulation transforms the initial-boundary value problem of governing partial differential equations of motion into a boundary value problem of ordinary differential equations. First, a standard procedure such as finite differences is employed to discretize time derivatives. Then, a line solution technique such as the Riccati transfer matrix method is utilized to integrate the spatial derivatives. The stability and accuracy of the CSDT Riccati transfer matrix method using the Newmark generalized acceleration formulation for time discretization is studied. Dissert. Abstr.

N79-30570*# Lamont-Doherty Geological Observatory, Palisades, N. Y.
A NUMERICAL METHOD FOR DETERMINATION OF SOURCE TIME FUNCTIONS FOR GENERAL THREE-DIMENSIONAL RUPTURE PROPAGATION
Shamita Das 1979 36 p refs
(Grants NGR-33-008-146; NSF EAR-79-01810)
(NASA-CR-162139) Avail: NTIS HC A03/MF A01 CSCL 20K

A method to determine the displacement and the stress on the crack plane for a three-dimensional shear crack of arbitrary shape propagating in an infinite, homogeneous medium which is linearly elastic everywhere off the crack plane is presented. The main idea of the method is to use a representation theorem in which the displacement at any given point on the crack plane

is written as an integral of the traction over the whole crack plane. As a test of the accuracy of the numerical technique, the results are compared with known solutions for two simple cases. G.Y.

N79-30571# Royal Aircraft Establishment, Farnborough (England).

IMPROVEMENT IN THE STATISTICAL INFORMATION YIELDED BY ENDURANCE STRENGTH TESTS (STAIRCASE METHOD)

M. Hueck and Baer Mar. 1979 105 p refs Transl. into ENGLISH from West German report TF-651B, IABG MBH, 1977 105 p

(RAE-Lib-Trans-2004; BR68896) Avail: NTIS HC A06/MF A01

The staircase method for determining the fatigue limit of materials and components was reassessed with the aim of reducing confidence limits to reduce the number of tests necessary for a certain statistical margin of safety. As a result of statistical evaluations of fatigue tests simulated by computer it was found that current staircase methods considerably underestimate the standard deviation of the results. Methods are described for estimating the mean, standard deviation and associated confidence zones using all occuring events in the staircase method such that 20% fewer tests are required compared to other methods to achieve the same confidence zones. R.E.S.

N79-30572*# Army Materials and Mechanics Research Center, Watertown, Mass.

AMMRC AUTOMATED STRESS-STRAIN DATA ANALYSIS, STORAGE, AND RETRIEVAL. PART 3: COMPUTER PROGRAM LISTINGS Final Report

Ralph P. Papirno Apr. 1979 69 p refs 2 Vol.

(AD-A069402; AMMRC-TR-79-18) Avail: NTIS HC A04/MF A01 CSCL 20/11

FORTRAN program listings are given for all the computer programs used in the reduction, analysis, storage, and retrieval of experimental stress-strain data. The program files which are listed are R*PICPTS for data reduction, R*EVALRO for data analysis, R*RETRIEVE for retrieval of computer-stored data, and R*FIXBANK for data entry into the computer memory. Description of the procedures for using the programs are given in AMMRC TR 79-16 and AMMRC TR 79-17. One objective of the developed computer procedures was to make in-house data readily available and hence more useful to the Engineering Standardization Division in their continuous efforts to improve standards and tolerances for material. GRA

N79-30573# Army Materials and Mechanics Research Center, Watertown, Mass.

AMMRC AUTOMATED STRESS-STRAIN DATA ANALYSIS, STORAGE, AND RETRIEVAL. PART 1: DATA ANALYSIS PROGRAM Final Report

Ralph P. Papirno Apr. 1979 24 p refs 2 Vol.

(AD-A069401; AMMRC-TR-79-16) Avail: NTIS HC A02/MF A01 CSCL 20/11

As part of an in-house effort to improve physical standards and tolerances for materiel through the improvement of acceptance/rejection criteria, we have developed a procedure for computer processing, storage, and retrieval of mechanical properties data. In this report, which is the first of a three-part series, a system for computer-assisted stress-strain test data reduction and analysis is described. Autographic recordings of load-strain data are semi-automatically digitized on a remote graphics terminal coupled to a UNIVAC 1106 computer. Descriptor data are also entered into temporary memory of the computer. The analysis includes a calculation of the Ramberg-Osgood exponent and yield stress from which the stress-strain curve of the test material can be readily reproduced. The output of the analysis program consists of several optional printouts for each set of test data and a punch card containing coded descriptor data and a summary all the results for the test. The output punch cards serve as a hard copy data file of test results. The system has been applied to establish a file of tension test results. The procedures for establishing a computer data file of the test results and for retrieving the data are described in AMMRC TR 79-17, and listings of the FORTRAN symbolic programs used for data reduction, analysis, storage, and retrieval are given in AMMRC TR 79-18. GRA

N79-30574# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Mechanical Engineering Aeronautical Engineering and Mechanics.

A THEORY OF THERMOVISCOPLASTICITY BASED ON INFINITESIMAL TOTAL STRAIN

E. P. Cernocky and E. Krempl Apr. 1979 46 p

(Contract N00014-76-C-0231)

(AD-A069597; RPI-CS-79-1) Avail: NTIS HC A03/MF A01 CSCL 20/11

A theory of three-dimensional infinitesimal isotropic thermoviscoplasticity is proposed and investigated in several homogeneous deformations. The theory is represented by both a mechanical constitutive equation and a constitutive assumption for the heat equation; these equations are separately postulated but are coupled through their common linear dependence upon the stress rate and strain rate tensors and the time rate of temperature change, and through their common nonlinear dependence upon the stress and strain tensors and the absolute temperature. Throughout this theory total strain is used and the strain tensor is not decomposed into a sum of elastic and inelastic contributions. The concept of the yield surface is not employed and the transition from initially linear thermoelastic behavior to nonlinear inelastic behavior is continued. GRA

N79-30575# Army Materials and Mechanics Research Center, Watertown, Mass.

AMMRC AUTOMATED STRESS-STRAIN DATA ANALYSIS, STORAGE, AND RETRIEVAL. PART 2: DATA BANK ENTRY AND RETRIEVAL PROCEDURES Final Report

Ralph P. Papirno Apr. 1979 19 p refs

(AD-A069834; AMMRC-TR-79-17-Pt-2) Avail: NTIS HC A02/MF A01 CSCL 20/11

As part of an in-house effort to improve physical standards and tolerances for materiel through the improvement of acceptance/rejection criteria we have developed a procedure for computer processing, storage, and retrieval of mechanical properties data. This second report of a three-part series describes a computer data bank of stress-strain data and the procedures used to access the data and to update the computer-stored data files. The data bank may be accessed through graphics or teletype remote terminals. User instructions for accessing the data are given, various selective retrieval options for the available material/alloy categories are presented, and various optional tabular listings from graphics and teletype terminals are also described. The retrieval program also includes an option for obtaining a graphical display of up to three stress-strain curves on the screen of a graphics terminal and a sample set of curves is shown. The simple updating procedures for the data bank are also described. Procedures for reducing and analyzing the test data are given in AMMRC TR 79-16, which is Part 1 of the three-part series of reports. FORTRAN listings of all the computer programs used for data reduction, analysis, storage, and retrieval are given in AMMRC TR 79-18, which is Part 3. GRA

N79-30576# California Univ., San Diego. Dept. of Applied Mechanics and Engineering Sciences.

NOTE ON THE EFFECT OF TRANSVERSE SHEAR DEFORMATION IN LAMINATED ANISOTROPIC PLATES

E. Reissner Apr. 1979 13 p refs

(Contract N00014-75-C-0158)

(AD-A069643) Avail: NTIS HC A02/MF A01 CSCL 20/11

Derivation of two-dimensional equations for elastic deformations of laminated anisotropic plates, based on the assumption of a Kirchhoff-distribution of primary strains, in conjunction with the use of the Castigliano variational principle for stresses, or a variational principle for stresses and displacements. A discussion is given on the relation of the present work to some earlier work. GRA

N79-30577# Illinois Univ. at Urbana-Champaign. Dept. of Aeronautical and Astronautical Engineering.

AN IMPROVED NONLINEAR DYNAMIC ANALYSIS OF FLAT LAMINATED PLATES Final Report, 1 Jan. - 31 Dec. 1977

Adam R. Zak and Daniel W. Pillasch Mar. 1979 32 p refs

(Contract DAAD05-77-C-0722; DA Proj. 1L1-61102-AH-43)

(AD-A069670; AD-E430240; ARBRL-CR-00394) Avail: NTIS HC A03/MF A01 CSCL 13/13

An improved finite element structural model has been developed for the dynamic analysis of flat laminated plates. This model is an extension of a model which has been developed and reported previously. The original model uses constant thickness quadrilateral elements to represent the shape of the plate with the elements stacked in thickness direction to account for the material properties of each layer. The new model allows for orthotropic elastic-visco-plastic material response and it uses finite difference equations for the time integration technique. Simplifying approximation allows for the use of large time increments in the finite difference equations for time integration. GRA

N79-30578# Sandia Labs., Albuquerque, N. Mex. Analytical Mechanics Div.

DERIVATION OF THE COUPLED EQUATIONS OF MOTION OF A BEAM SUBJECTED TO THREE TRANSLATIONAL ACCELERATIONS AND THREE ROTATIONAL ACCELERATIONS

G. A. Benedetti Feb. 1979 108 p refs

(Contract EY-76-C-04-0789)

(SAND-79-8202) Avail: NTIS HC A06/MF A01

Equations of motion are derived to describe the coupled (axial, torsional, and lateral) dynamic response of a uniform Bernoulli-Euler beam, of constant circular cross-section, subjected to three specified translational accelerations and three specified rotational accelerations. The boundary condition equations are those for a cantilever beam with a symmetrical rigid mass attached to the free end of the beam. The resulting equations of motion (and boundary conditions) are nonlinear. However, for many problems, these equations can be reduced and simplified to a form more amenable to solution. DOE

N79-30579# Bendix Corp., Kansas City, Mo.

QUANTITATIVE COMPARISON OF ELECTRONIC COMPONENT/SOLDER JOINT STRESS RELIEF IN ENCAPSULATED ASSEMBLIES

D. A. Cummings 1979 8 p refs Presented at 29th Electronic Components Conf., Cherry Hill, N. J., 14-16 May 1979

(Contract EY-76-C-04-0613)

(BDX-613-2185; Conf-790506-4) Avail: NTIS HC A02/MF A01

A quantitative comparison was made of various stress relief bends with and without sleeving in three commonly used encapsulants. Silicone rubber and heat shrinkable polyolifin sleeving were used on right angle, full loop, and hump style lead bends. Small and large wires were used to simulate small and large component leads. The component leads were encapsulated in microballoon-filled epoxy, 128 kg/m3 urethane foam, and 320 kg/m3 urethane foam. Ten test samples were fabricated in each configuration; five were used for tensile loading, and five were used for compressive loading. DOE

N79-30580# European Space Agency, Paris (France).

SPECTRAL PROBLEMS IN VIBRATION MECHANICS

Jacqueline Boujot Feb. 1979 67 p refs Transl. into ENGLISH of 'Probl. Spectraux en Mecan. des Vibrations', ONERA, Paris Report ONERA-P-1978-2, 1978 Original report in FRENCH previously announced as ESA-91090

(ESA-TT-497; ONERA-P-1978-2) Avail: NTIS HC A04/MF A01

Vibration problems in linear theory are related to fundamental theory in functional and spectral analysis. Some results on spectral decomposition and spectral variational properties are recalled. A general theorem for linear oscillation is proven and some applications studied. It is shown that together with retrieving classical results, new problems may be solved, such as coupled problems in vibration mechanics. An introduction to numerical analysis and computational techniques is given with application to system vibration modes. Author (ESA)

N79-30581# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.

EXPLICIT TIME INTEGRATION OPERATORS FOR NONLINEAR STRUCTURAL DYNAMICS

W. C. Knudson and G. V. Suryakumar Sep. 1978 107 p refs (ISD-250) Avail: NTIS HC A06/MF A01

Explicit temporal algorithms, advantagous for nonlinear structural dynamics problems, are considered as they require less computation time per time step and less storage than implicit algorithms. Of the explicit methods used, Newmark's (beta = 0) method and the central difference method are similar. The stability and accuracy characteristics of these methods are widely studied and well established. Two recent explicit methods, Fu's method and Trujillo's method (alternating direction explicit) are also examined for their stability and accuracy characteristics. Finally, the accuracy and computer time requirements of Newmark's (beta = 0) algorithm and the higher order cubic Hermitian algorithm, both implemented within the LARSTRAN computer package, are compared. Additional comparisons with the alternating direction explicit method are also provided.

Author (ESA)

N79-30582# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.

DEVELOPMENTS IN THE INELASTIC ANALYSIS OF QUASISTATIC AND DYNAMIC PROBLEMS

J. H. Argyris, J. St. Doltsinis, and K. J. Willam 1978 63 p refs Presented at Intern. Congr. on Numerical Methods for Eng., Paris, 27 Nov. - 1 Dec. 1978

(ISD-252) HC A04/MF A01

Computational aspects are examined for the numerical analysis of inelastic structures and continua. In this context the tracing of quasistatic and dynamic motions is considered with particular emphasis on the interaction of nonlinear and transient problems. Explicit and implicit solution schemes are developed for the numerical integration of inelastic first order rate processes governing creep, visoelasticity, and viscoplasticity. The exposition is extended to second order inertial problems and in particular to the field of dynamic plasticity devoting special attention to the kinematics of finite deformation problems. Author (ESA)

N79-30583# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Strukturmechanik.

POTENTIAL APPLICATIONS AND LIMITATIONS OF ROD-BEAM THEORIES

Dieter Petersen Jul. 1978 42 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-568)

(DLR-FB-78-13) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 17,50

The assumptions inherent in the hypotheses of rod-beam theories, such as the one of Bernoulli suggesting even cross-sections under deformation, limit the accuracy of analysis. It is shown that for higher order terms geometrically nonlinear deformations are in contradiction with rod-beam hypotheses. The consistent use of differential calculus simultaneously uncovers geometric differences between current rod-beam theories of higher order. These differences are examined using simple examples.

Author (ESA)

N79-30584# Construcciones Aeronauticas S.A., Madrid (Spain). Space Div.

STUDY OF HIGH STABILITY STRUCTURAL SYSTEMS: PRE-PHASE A Final Report

Paris ESA 29 Sep. 1978 160 p refs

(Contract ESTEC-3398/77/NL-PP(SC))

(DT-HSS-5; ESA-CR(P)-1164) Avail: NTIS HC A08/MF A01

The feasibility of large, high stability, flat, deployable antennas for earth resources observation was studied. A synthetic aperture radar antenna, 10 meters long by 1 meter wide, was taken as a representative structure of this type. Requirement definitions, interface design constraints, and a trade-off analysis of different solutions were considered. Possible design concepts and an analysis of the thermal loads were studied. Due to the different possibilities of the design configurations, strongly depending on some not well defined interfaces during development, the mechanical bahavior of the presented designs are omitted or studied in a simplified manner. Author (ESA)

N79-30585# European Space Agency, Paris (France).

THERMODYNAMIC AND PHENOMENOLOGICAL DESCRIPTION OF CYCLIC VISCOPLASTICITY WITH DAMAGE

Jean-Louis Chaboche May 1979 284 p refs Transl. into

ENGLISH of 'Description Thermodynamique et Phenomenologique de la Viscoplasticite Cyclique avec Endommagement', ONERA, Paris Report ONERA-NT-1978-3, 1978
(ESA-TT-548; ONERA-P-1978-3) Avail: NTIS HC A13/MF A01

A thermodynamic description of structural behavior, introducing internal variables, is used to propose and develop a number of phenomenological laws. In particular, the problems of modeling the cyclic behavior of metallic materials are studied as well as those aspects related to the damage processes of the materials which lead to damage failure (macroscopic crack initiation phase). The formulation adopted uses three types of internal variables. These are isotropic hardening, kinematic hardening, and the damage variable whose introduction into a general three dimensional context is discussed in detail. Particular attention is paid to the problems of the relationship between damage and behavior in deformation as well as a priori verification of the second law of thermodynamics. A three dimensional cyclic viscoplastic constitutive equation is proposed that makes it possible to describe the effects of viscoplasticity (creep-relaxation), strain hardening, Bauschinger effects, cyclic softening or hardening, cycle stabilization, recovery effects, and history effects. Two damage models are also introduced which described independently the processes of creep and fatigue damage by introducing nonlinear cumulation effects. These models are generalized to the three dimensional case by taking into account earlier published experimental results. Author (ESA)

N79-30586# National Technical Information Service, Springfield, Va.
STRUCTURAL MECHANICS SOFTWARE, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1975 - May 1979
Brian Carrigan Jun. 1979 273 p
(NTIS/PS-79/0572) Avail: NTIS. HC $28.00/MF $28.00 CSCL 20K

The use of computer programs in structural analysis-design problems are cited. Detailed analyses are included of structural problems-applied and theoretical-including stress analysis, vibration, deformation, etc. The major computer programs cited in this report are NASTRAN, EPSOLA, SUPERSCEPTRE, and SINGER. (This updated bibliography contains 265 abstracts, 51 of which are new entries to the previous edition). GRA

42 GEOSCIENCES (GENERAL)

N79-30587# Geological Survey, Washington, D. C.
CLIMATIC IMPLICATIONS OF TWO POLLEN ANALYSES FROM NEWLY RECOGNIZED ROCKS OF LATEST PLIOCENE AGE IN THE WASHBURN RANGE, YELLOWSTONE NATIONAL PARK, WYOMING
Gerald M. Richmond, William Mullenders (Universite Catholique de Louvain), and Mady Coremans (Universite Catholique de Louvain) 1978 16 p refs
(USGS-Bull-1455) Avail: NTIS HC A01; SOD HC

Pollen analyses of siltstone beds in sedimentary rocks that overlie and closely resemble the basal sedimentary unit of the Eocene volcanic sequence in the Washburn Range, north central Yellowstone National Park, yielded pollen types and percentages indicative of an age no older than latest Pliocene. These sedimentary rocks are lithologically similar to others that lie conformably beneath the slightly more than 2.0 million year old Junction Butte Basalt and are therefore no younger than latest Pliocene in age. The geomorphic setting of the sediments in a north trending paleovalley suggests that their source was an upland to the south in an area of central Yellowstone Park which has since foundered because of caldera collapse. Comparison of the pollen analyses of the sediments at two localities and the altitudes of the localities with the modern pollen rain and altitude limits of present day forest associations suggests that the vegetation zones and climate in latest Pliocene time were broadly similar to present conditions. The sedimentary rocks are correlated with others in and near Yellowstone Park on the basis of their overall relation to the Huckleberry Ridge Tuff, which overlies the Junction Butte Basalt and is also potasium-argon dated as slightly more than 2 million years old. Author

N79-30588# Wiggins (J. H.) Co., Redondo Beach, Calif.
NATURAL HAZARDS: EARTHQUAKE, LANDSLIDE, EXPANSIVE SOIL LOSS MODELS
J. H. Wiggins, J. E. Slosson, and J. P. Krohn Dec. 1978 166 p refs
(Grants NSF ERS-75-09998; NSF AEN-74-23992)
(PB-294686/1; NSF/PRA-7509998/2) Avail: NTIS HC A08/MF A01 CSCL 05C

Natural hazards generally associated with earth movement are considered, namely, earthquake, landslide, and expansive soil. Each hazard was modeled with regard to national and sudden loss projections. Mitigations were applied to the theoretical national loss, earth hazard models. It was determined that if the most effective mitigations were invoked beginning in the year 1981, approximately 24 percent of the annual loss projected by the year 2000 could be saved. It was determined that earthquake is by far the most extreme type of hazard and also affords the greatest possibility of sudden loss reduction should adequate warning be given and consequent appropriate actions taken to reduce the risk. GRA

N79-30589# Wiggins (J. H.) Co., Redondo Beach, Calif.
NATURAL HAZARDS: SOCIO-ECONOMIC IMPACT ASSESSMENT MODEL
Joseph G. Hirschberg, Peter Gordon, and William J. Petak Jul. 1978 320 p refs
(Grants NSF ERS-75-09998; NSF AEN-74-23992)
(PB-294681/2; NSF/PRA-7509998/5) Avail: NTIS HC A14/MF A01 CSCL 05C

The models that were used to measure the expected losses that are associated with a variety of natural disasters are reported. Data sources and data manipulations that were required to make the models operational are reviewed. The tenets of cost benefit analysis were adopted as a framework. The models are built on the premise that the probabilities of various disasters and the intensities of these disasters can be jointly predicted for future time periods for small regions. The tests and applications of the methodology, sensitivity tests, tests on known historical disaster events, and actual cost benefit analysis of selected mitigation measures are presented. GRA

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N79-30590* National Aeronautics and Space Administration, Washington, D. C.
EARTH RESOURCES: A CONTINUING BIBLIOGRAPHY WITH INDEXES, ISSUE 22, JULY 1979
Jul. 1979 96 p
(NASA-SP-7041(22)) Avail: NTIS HC E05 CSCL 05B

This bibliography lists 390 reports, articles, and other documents introduced into the NASA scientific and technical information system between 1 April 1979 and 30 June 1979. Emphasis is placed on the use of remote sensing and geophysical instrumentation in spacecraft and aircraft to survey and inventory natural resources and urban areas. Subject matter is grouped according to agriculture and forestry, environmental changes and cultural resources, geodesy and cartography, geology and mineral resources, hydrology and water management, data processing and distribution systems, instrumentation and sensors, and economic analysis. K.L.

N79-30591*# Department of Agriculture, Weslaco, Tex. Science and Education Administration.
PLANT COVER, SOIL TEMPERATURE, FREEZE, WATER STRESS, AND EVAPOTRANSPIRATION CONDITIONS Quarterly Progress Report, 1 Mar. - 1 Jun. 1979
Craig L. Wiegand, Paul R. Nixon, Harold W. Gausman, L. Neal Namken, Ross W. Leamer, and Arthur J. Richardson, Principal

Investigators Jun. 1979 8 p ERTS
(NASA ORDER S-40198-B)
(E79-10230; NASA-CR-158638) Avail: NTIS HC A02/MF A01 CSCL 06C
There are no author-identified significant results in this report.

N79-30592*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
GEOLOGICAL FAULT ON A MILLIONTH SCALE, SAN FRANCISCO RIVER [FOLHA GEOLOGICA AOMIL-LIONESIMO, RIO SAO FRANCISCO]
Nelson DeJesusParada, Principal Investigator, Paulo Roberto Meneses, Athos Ribeiro dosSantos, Ubiratan Porto dosSantos, Paulo Veneziani, and Chan Chiang Liu Sep. 1978 123 p refs Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E79-10231; NASA-CR-158795) Avail: NTIS HC A06/MF A01 CSCL 08G
There are no author-identified significant results in this report.

N79-30593*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
GEOLOGIC APPLICATIONS OF THERMAL INERTIA IMAGE USING HCMM DATA Quarterly Report, Jan. - Mar. 1979
Anne B. Kahle, Principal Investigator, Helen H. Paley, and Stuart E. Marsh 30 May 1979 7 p Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Contract NAS7-100)
(E79-10232; NASA-CR-158796; HCM-028) Avail: NTIS HC A02/MF A01 CSCL 08G
The author has identified the following significant results. Comparison of a simulated HCMM image of the Pisgah Crater, California test site obtained from aircraft data with an image generated from the preliminary satellite data tape of the area indicates that the HCMM satellite data appears much as predicted by the simulation. Author

N79-30594*# Great Lakes Basin Commission, Ann Arbor, Mich.
STATE-REGIONAL FUTURE GREAT LAKES REGION: THE 1975 NATIONAL WATER ASSESSMENT
Jul. 1976 179 p refs Sponsored by NASA ERTS
(E79-10233; NASA-CR-158797) Avail: NTIS HC A09/MF A01 CSCL 08H
There are no author-identified significant results in this report.

N79-30595*# Forest Service, Wenatchee, Wash.
ENVIRONMENTAL STATEMENT: KITTITAS LAND MANAGEMENT PLAN, WENATCHEE NATIONAL FOREST, KITTITAS AND CHELAN COUNTIES, WASHINGTON Final Report
27 Jun. 1979 373 p refs ERTS
(E79-10234; NASA-CR-158798; USDA-FS-R6-FES(ADM)78-15) Avail: NTIS HC A16/MF A01 CSCL 02F
There are no author-identified significant results in this report.

N79-30596*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
EFFECT OF THE ATMOSPHERE ON THE CLASSIFICATION OF LANDSAT DATA
Nelson DeJesusParada, Principal Investigator, T. Morimoto, R. Kumar, and L. C. B. Molion Apr. 1979 11 p refs Presented at Symp. on Machine Processing of Remotely Sensed Data, Lafayette, Ind., 1979 Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E79-10235; NASA-CR-158799; INPE-1467-RPE/020) Avail: NTIS HC A02/MF A01 CSCL 05B
The author has identified the following significant results. In conjunction with Turner's model for the correction of satellite data for atmospheric interference, the LOWTRAN-3 computer program was used to calculate the atmospheric interference. Use of the program improved the contrast between different natural targets in the MSS LANDSAT data of Brasilia, Brazil. The classification accuracy of sugar canes was improved by about 9% in the multispectral data of Ribeirao Preto, Sao Paulo. Author

N79-30597*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
CLASSIFICATION OF AREAS USING PIXEL-BY-PIXEL AND SAMPLE CLASSIFIERS
Nelson deJesusParada, Principal Investigator, R. Kumar, M. Niero, A. P. Manso, L. A. M. Lucht, and M. S. S. Barros Apr. 1979 16 p refs Presented at Intern. Conf. on Machine-Aided Image Analysis, Oxford, Engl., 4-6 Sep. 1978 Sponsored by NASA ERTS
(E79-10236; NASA-CR-158800; INPE-1472-RPE/023) Avail: NTIS HC A02/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N79-30598*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
USE OF AUTOMATIC EXTRACTION OF LANDSAT DATA DEFINING AREAS OF ILMENITE IN THE FOREST OF THE STATE OF PERNAMBUCO [USO DA CLASSIFICACAO AUTOMATICA DE DADOS DO SATELITE LANDSAT NA DEFINICAO DE AREAS DE ILMENITA PRIMARIA EN FLORESTA, PERNAMBUCO]
Nelson deJesusParada, Principal Investigator, Sylvio de Queiros Mattoso, Waldir Renato Paradella, and Paulo Roberto Meneses Jan. 1979 35 p refs In PORTUGUESE; ENGLISH summary ERTS
(E79-10237; NASA-CR-158801; INPE-1415-RPE/003) Avail: NTIS HC A03/MF A01 CSCL 02F
The author has identified the following significant results. Classification results point out 600 alarm areas of high potentiality of titanium occurrence. Almost 80 of these 600 alarm areas were checked by field work, and in 56 of them, titanium occurrences were confirmed and four new ore deposits were found. Author

N79-30599*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
REMOTE SENSORS APPLIED TO THE PROSPECTING OF THERMOMINERAL WATERS IN THE MUNICIPALITY OF CALDAS NOVAS-GOIAS [SENSORES REMOTOS APLICADOS A PROSPECCAO DE AGUAS TERMOMINERAIS NO MUNICIPIO DE CALDAS NOVAS-GOIAS]
Nelson deJesusParada, Principal Investigator, Paulo Veneziani, and Celio Eustaquio dosSanjos Jan. 1979 16 p refs In PORTUGUESE Sponsored by NASA ERTS
(E79-10238; NASA-CR-158802; INPE-1413-RPE/001) Avail: NTIS HC A02/MF A01 CSCL 08H
There are no author-identified significant results in this report.

N79-30600*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
DIGITAL PROCESSING OF LANDSAT MSS AND TOPOGRAPHIC DATA TO IMPROVE CAPABILITIES FOR COMPUTERIZED MAPPING OF FOREST COVER TYPES Quarterly Progress Report, 16 Jan. - 15 Apr. 1979
Roger M. Hoffer, Principal Investigator Apr. 1979 8 p EREP
(Contract NAS9-15508)
(E79-10241; NASA-CR-160264; LARS-CR-041579) Avail: NTIS HC A02/MF A01 CSCL 08B
There are no author-identified significant results in this report.

N79-30601*# Texas A&M Univ., College Station. Remote Sensing Center.
LANDSAT RANGE RESOURCE INFORMATION SYSTEM PROJECT, VOLUME 1 Final Report, Dec. 1977 - Aug. 1979
Harold Chilton, J. Clifford Harlan, Principal Investigators, and W. E. Boyd Jun. 1979 73 p EREP
(Contract NAS9-15468)
(E79-10242; NASA-CR-160270; RSC-3697-5) Avail: NTIS HC A04/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N79-30602*# Environmental Research Inst. of Michigan, Ann Arbor.
THE ANALYSIS OF SCANNER DATA FOR CROP INVENTORIES Progress Report, 15 Nov. 1978 - 6 Mar. 1979
Quentin A. Holmes, Principal Investigator, R. J. Kauth, R. C. Cicone, and W. A. Malila Mar. 1979 47 p refs EREP
(Contract NAS9-15476)
(E79-10243; NASA-CR-160259; ERIM-132400-20-P) Avail: NTIS HC A03/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N79-30603*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
CORN YIELD MODEL FOR RIBEIRAO PRETO, SAO PAULO STATE, BRAZIL
Nelson deJesusParada, Principal Investigator, Sherry Chou Chen, and Lourdes Bernadete daFonseca May 1979 15 p refs In PORTUGUESE; ENGLISH summary Sponsored by NASA Submitted for publication ERTS
(E79-10244; NASA-CR-158807; INPE-1488-RPE/034) Avail: NTIS HC A02/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N79-30604*# Delaware Univ., Newark. Coll. of Marine Studies.
APPLICABILITY OF SPACECRAFT REMOTE SENSING TO THE MANAGEMENT OF FOOD RESOURCES IN DEVELOPING COUNTRIES
V. Klemas and D. J. Leu, Principal Investigators 31 Mar. 1977 55 p refs Sponsored by NASA and NSF ERTS
(E79-10245; NASA-CR-158808; CRS-1-79) Avail: NTIS HC A04/MF A01 CSCL 05A

There are no author-identified significant results in this report.

N79-30605*# Kansas Univ. Center for Research, Inc., Lawrence.
THE APPLICATION OF REMOTE SENSING TO RESOURCE MANAGEMENT AND ENVIRONMENTAL QUALITY PROGRAMS IN KANSAS Annual Report, 1 Apr. 1978 - 31 Mar. 1979
B. G. Barr, Principal Investigator and E. A. Martinko Jul. 1979 101 p Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Grant NGL-17-004-024)
(E79-10246; NASA-CR-158809) Avail: NTIS HC A06/MF A01 CSCL 13B

There are no author-identified significant results in this report.

N79-30606*# Texas A&M Univ., College Station. Remote Sensing Center.
CORRELATION OF SPACECRAFT PASSIVE MICROWAVE SYSTEM DATA WITH SOIL MOISTURE INDICES (API) Progress Report, Aug. 1978 - Feb. 1979
Bruce J. Blanchard, Principal Investigator Feb. 1979 9 p ref ERTS
(Grant NsG-5193)
(E79-10247; NASA-CR-158810; RSC-3622-1) Avail: NTIS HC A02/MF A01 CSCL 08M

There are no author-identified significant results in this report.

N79-30607*# National Oceanic and Atmospheric Administration, Washington, D. C.
APPLICATIONS OF HCMM DATA TO SOIL MOISTURE SNOW AND ESTUARINE CURRENT STUDIES Quarterly Report
Donald R. Wiesnet, Principal Investigator, David F. McGinnis, Jr., and Michael Matson 17 Jul. 1979 11 p ERTS
(NASA Order S-40229-B)
(E79-10248; NASA-CR-158794) Avail: NTIS HC A02/MF A01 CSCL 08M

There are no author-identified significant results in this report.

N79-30608# RAND Corp., Santa Monica, Calif.
ADJUSTMENT AND VERIFICATION OF THE RAND-DELTA 2 MODEL
A. Langerak (Delft Hydraulics Lab.), M. A. M. Deras (Rijkswaterstaat), and J. J. Leendertse Sep. 1978 24 p refs Presented at the 16th Intern. Conf. on Coastal Eng., Hamburg, 1978
(P-6247) Avail: NTIS HC A02/MF A01

In the mid-1950s the Netherland government embarked on a massive dike and dam construction program, called the Delta Plan. Its purpose was to enhance protection from floods caused by the North Sea in the estuaries of the Rhine, Meuse and Scheldt. In support of engineering and environmental studies related to the construction and operation of a storm barrier (revised plan), a large numerical model was developed which covers the Eastern and Western Scheldt and the adjacent offshore area. The section of the North Sea which is included in the model is about 120 km long and 30 kn wide, running from Blankengerghe in Belgium to Scheveningen in the Netherlands. Topics discussed include: (1) model formulation; (2) computation approximation; (3) modeling system; (4) aspects of tidal wave propagation in the model area; (5) submodels; and (6) model adjustment and verification. G.Y.

N79-30609# California Univ., Berkeley. Lawrence Berkeley Lab.
GEOTHERMAL EXPLORATION ASSESSMENT AND INTERPRETATION, KLAMATH BASIN, OREGON - SWAN LAKE AND KLAMATH HILLS AREA
M. Stark, N. Goldstein, H. Wollenberg, B. Strisower, H. Hege, and M. Wilt May 1979 83 p refs
(Contract W-7405-eng-48)
(LBL-8186) Avail: NTIS HC A05/MF A01

A synthesis and preliminary interpretation of predominantly geophysical information relating to the Klamath Basin geothermal resource is presented. The Swan Lake Valley area, northeast of Klamath Falls, and the Klamath Hills area, south of Klamath Falls, are discussed in detail. Available geophysical data, including gravity, magnetic, electrical resistivity, microearthquake, roving dipole resistivity, audio magnetotelluric (AMT) and magnetotelluric (MT) data sets, are examined and reinterpreted for these areas. One and two dimensional modeling techniques are applied, and general agreement among overlapping data sets is achieved. The MT method appears well suited to this type of exploration, although interpretation is difficult in the complex geology. Roving dipole and AMT are useful in reconnaissance, while gravity and magnetics help in defining structure. Author

N79-30610*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DECISION RULES FOR UNBIASED INVENTORY ESTIMATES
P. Argentiero and David Koch Jul. 1979 27 p refs
(NASA-TM-80303) Avail: NTIS HC A03/MF A01 CSCL 05B

An efficient and accurate procedure for estimating inventories from remote sensing scenes is presented. In place of the conventional and expensive full dimensional Bayes decision rule, a one-dimensional feature extraction and classification technique was employed. It is shown that this efficient decision rule can be used to develop unbiased inventory estimates and that for large sample sizes typical of satellite derived remote sensing scenes, resulting accuracies are comparable or superior to more expensive alternative procedures. Mathematical details of the procedure are provided in the body of the report and in the appendix. Results of a numerical simulation of the technique using statistics obtained from an observed LANDSAT scene are included. The simulation demonstrates the effectiveness of the technique in computing accurate inventory estimates. Author

N79-30611*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A COMPARATIVE STUDY OF MICROWAVE RADIOMETER OBSERVATIONS OVER SNOWFIELDS WITH RADIATIVE TRANSFER MODEL CALCULATIONS
A. T. C. Chang and J. C. Shiue May 1979 31 p refs Submitted

for publication
(NASA-TM-80267) Avail: NTIS HC A03/MF A01 CSCL 08L

Truck mounted microwave instrumentation was used to study the microwave emission characteristics of the Colorado Rocky Mountain snowpack in the vicinity of Fraser, Colorado during the winter of 1978. The spectral signatures of 5.0, 10.7, 18, and 37 GHz radiometers with dual polarization were used to measure the snowpack density and temperature profiles, rain profile, and free water content. These data were compared with calculated results based on microscopic scattering models for dry, surface melting, and very wet snowpacks. K.L.

N79-30612*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTERPRETING VEGETATION REFLECTANCE MEASUREMENTS AS A FUNCTION OF SOLAR ZENITH ANGLE
D. S. Kimes, J. A. Smith (Colorado State Univ., Ft. Collins), and K. J. Ranson (Colorado State Univ., Ft. Collins) Jul. 1979 35 p refs Submitted for publication
(NASA-TM-80320) Avail: NTIS HC A03/MF A01 CSCL 08F

Spectral hemispherical-conical reflectances of a nadir looking sensor were taken throughout the day for a lodgepole pine and two grass canopies. Mathematical simulations of both spectral hemispherical-conical and bi-hemispherical reflectances were performed for two theoretical canopies of contrasting geometric structure. These results and comparisons with literature studies showed a great amount of variability of vegetation canopy reflectances as a function of solar zenith angle. Explanations for this variability are discussed and recommendations for further measurements are proposed. K.L.

N79-30613# European Space Agency, Paris (France).
EARTH OBSERVATION FROM SPACE AND MANAGEMENT OF PLANETARY RESOURCES
J. Plevin, ed, V. Hood, ed, T. D. Guyene, ed, and S. Adamy May 1978 671 p refs Partly in FRENCH and ENGLISH Proc. of ESA/CNES Intern. Conf., Toulouse, 6-11 Mar. 1978; co-sponsored by Council of Europe, CEC, European Assoc. of Remote Sensing Labs. Original contains color illustrations
(ESA-SP-134) Avail: NTIS HC A99/MF A01

The state of the art of satellite observation technology and considerations on the management and economic aspects are reviewed. For individual titles, see N79-30614 through N79-30682.

N79-30614*# National Aeronautics and Space Administration, Washington, D. C.
LACIE (LARGE AREA CROP INVENTORY EXPERIMENT) PROGRAMME
Ruth I. Whitman *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 13-16 refs (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01 CSCL 02C

Large Area Crop Inventory Experiment was a three year experiment conducted jointly by the United States Department of Agriculture, NASA, and NOAA (National Oceanic and Atmospheric Administration) to determine if global wheat production can be forecast from LANDSAT data to within 90% of actual yield for each observed 9 years out of 10. Data for the third crop year (1976-1977) was compiled. The proportional area of cultivated land devoted to wheat was estimated based on a statistical sampling of LANDSAT data. Yield is presently estimated by NOAA using regression models developed from historical weather and yield information. Results are discussed.
Author (ESA)

N79-30615# Deutsche Akademie der Wissenschaften, Berlin (East Germany).
FIRST RESULTS OF THE EXPERIMENT RADUGA FOR PHOTOGRAPHIC REMOTE SENSING
H. Kautzleben, K.-H. Marek, A. Geschke, and R. Joachim *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 17-26 refs Original contains color illustrations (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

An experiment in photographic remote sensing, RADUGA (rainbow), carried out jointly by the USSR and the German Democratic Republic in 1976 is described. A multispectral camera MKF-6 and a multispectral projector MSP-4 were employed. Some examples of picture reprocessing techniques with additive color viewing are presented. Results concerning the interpretation of the photos obtained in this experiment are discussed. It is found that photos which are well suited for studying photogrammetrical and thematic sensing problems can be obtained from satellites and aircraft. Author (ESA)

N79-30616# European Atomic Energy Community, Ispra (Italy).
SUMMARY OF RESULTS OBTAINED DURING A EUROPEAN TELEDETECTION PROGRAM RELATED TO AGRICULTURE AND SILVICULTURE (AGRESTE PROJECT) [SYNTHESE DES RESULTATS ACQUIS DANS LE CADRE D'UN PROGRAMME DE COLLABORATION EUROPEENE EN TELEDETECTION, APPLIQUE A L'AGRICULTURE ET A LA SYLVICULTURE (PROJECT AGRESTE)]
A. Berg, G. Flouzat (Centre d'Etude Spatiale des Rayonnements), and S. GallideParatesi *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 27-40 refs In FRENCH; ENGLISH summary (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

Different methods for the classification of multispectral data were perfected and used to verify the feasibility of teledetection techniques in Europe for agricultural and silvicultural resources management. Observations made from LANDSAT satellites and aircraft were used. Results are reported refering to the identification of the four vegetal species chosen. The relationship between rice reflectance and vegetation structure makes it possible to predict yield nearly two months before harvest. The early identification of rice virus diseases through the detection of spectral modifications in the vegetal cover is another important result. A model to estimate wood production from the Garonne valley is also discussed. Author (ESA)

N79-30617# Centre National d'Etudes Spatiales, Toulouse (France).
ESTIMATION OF IRRIGATED SURFACES IN THE SEINE-NORMANDY BASIN [ESTIMATION DES SURFACES IRRIGUEES DU BASSIN SEINE-NORMANDIE]
G. Saint, G. Bediot (Agence Financiere de Bassin Seine-Normandie, Paris), and D. Clergeot (Univ. of Paris 1) *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 41-48 In FRENCH (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

A feasibility study for the estimation of irrigated surfaces in the Seine-Normandy basin was made from numerically treated LANDSAT satellite images. Results show that precision in measuring irrigated surfaces is better than that demanded by the regional agency. Nevertheless, an extension to the whole basin was limited by image availability. Author (ESA)

N79-30618# Waterloo Univ. (Ontario).
APPLICATION OF REMOTE SENSING TO THE ASSESSMENT OF WATER RESOURCES
S. I. Solomon and W. Klohn *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 49-61 refs Sponsored in part by WMO (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

A state of the art review of the applications of spatial remote sensing techniques for the assessment of the variables affecting the water cycle is presented. Emphasis is on the hydrological aspects and particularly the problems of flooding, snow, and ice. The application of remote sensing techniques to assess the geomorphical characteristics of river basins is also dealt with. A brief discussion of the future development needs of hydrologists and water resources managers is included.
Author (ESA)

N79-30619# Ecole Superieure de Genie Civil, Bucharest (Rumania).
RESULTS OBTAINED IN THE EVALUATION OF THE LOWER DANUBE BASIN AND DANUBE DELTA BY TELEDETECTION. TECHNOLOGY ADAPTED TO CURRENTLY AVAIL-

ABLE EQUIPMENT [RESULTATS OBTENUS DAN L'INVENTAIRE DES RESSOURCES DU BASSIN INFERIEUR DU DANUBE ET DANS LE DELTA DU DANUBE PAR TELEDETECTION; TECHNOLOGIES ADAPTEES AU CAS DES MOYENS RESTREINTS]

N. Oprescu and E. Mandescu (Comm. Roumaine de l'Activite Spatiale) *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 63-76 refs In FRENCH (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

A teledetection technique limited to the use of available equipment is presented. A mixed analog-digital data processing system was used, working with successive approximations and starting with a digital treatment. Data from the LANDSAT satellite were employed in monitoring specific variables in the domains of agriculture, hydrology, pollution, and geology. It is concluded that multispectral data processing must be digital and that teledetection will be helpful in predicting crop yield, pollution, water reserves, flooding, and other important environmental parameters. Conditions necessary to perfect the methods are discussed. Author (ESA)

N79-30620# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Munich (West Germany).

MASS APPEARANCE OF BLUE GREEN ALGAE IN THE BALTIC SEA: EVALUATION OF MULTISPECTRAL LANDSAT SCENES BY IMAGE PROCESSING

K. A. Ulbricht, D. Schmidt (Ger. Hydrographic Inst.), and U. Horstmann (Kiel Univ.) *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 77-89 refs (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

Accumulation of blue green algae, Nodularia spumigena and Alphanisomenon flos aquae, was detected from digital image processing of LANDSAT scenes of the Baltic sea. White traces appear in some spectral regions (MSS 4 and MSS 5), which are shown to be due to algae. Blue green algae participate in the fixing of nitrogen from the air and its abnormal growth is probably related to an increase in phosphate concentrations due to sewage discharge having a high phosphorus content in the regions near the sea coast. It is also concluded that space detected traces are to be complimented by in situ measurements in order to get reliable quantitative information. Author (ESA)

N79-30621# Universite des Sciences et Techniques de Lille (France). Lab. d'Optique Atmospherique.

INTERPRETATION OF THE SPECTRAL SIGNATURE OF SEA WATER [INTERPRETATION DE LA SIGNATURE SPECTRALE DES EAUX MARINES]

M. Viollier, N. Baussart, and P. Lecomte *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 81-88 refs In FRENCH (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

The variations in the reflectance of the ocean measured at different wave lengths was used to determine the content of chlorophyll and sediments as they modify the optical properties of sea water. The results obtained by teledetection and by local measurements for four types of water (coastal sea, North Sea, upwelling sea water, and Guinea Gulf) are presented. The precision of this method of determination of chlorophyll content is subject to several types of errors which are discussed. Author (ESA)

N79-30622# Operation Pilote Interministerielle de Teledetection, Paris (France).

UTILIZATION OF LANDSAT FOR THE INVENTORY AND CARTOGRAPHY OF SOIL USES AND FOR TERRITORIAL ADMINISTRATION. MAIN EXPERIMENTS CARRIED OUT DURING THE FRENCH TELEDETECTION INTERMINISTERIAL PILOT OPERATION (OPIT) [UTILISATION DE LANDSAT POUR L'INVENTAIRE ET LA CARTOGRAPHIE DE L'UTILISATION DU SOL ET L'AMENAGEMENT DU TERRITOIRE: PRINCIPALES EXPERIMENTATIONS MENEES PAR L'OPIT]

Marc Bied-Charreton *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 89-95 refs In FRENCH (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

Data from LANDSAT (soil use, humid areas, forest fires) pertinent to the Mediterranean region were numerically treated for an area of moderate altitude (Vosge's forests, Vivarais's forests), for an agriculture-sylviculture equilibrium zone (Limousin), and for a polyculture zone (Loire valley) in order to evaluate the usefulness of teledetection techniques vis a vis the needs of several government agencies (OPIT program). Several methodologic conclusions are listed, pointing out the insufficient development of various steps of the technical procedures. Conclusions relative to the contributions of teledetection are also listed. It is estimated that teledetection will satisfy most user's needs some years from now if the system elements are optimized.
Author (ESA)

N79-30623# Operation Pilote Interministerielle de Teledetection, Paris (France).

TELEDETECTION AND WATER RESOURCES [TELEDETECTION ET RESSOURCES EN EAU]

Claudine Valerio and Yves Vuillaume *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 97-102 refs In FRENCH (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

The role of interministerial collaboration in the Teledetection Interministerial Pilot Operation is pointed out and the main phases of the program are described. Two examples involving water pollution are given, covering the subjects of aircraft monitoring with teledetection of hydrocarbon pollution on the sea and simulation of sea water pollution by Rhodamine diffusion in the Propiano bay. Author (ESA)

N79-30624# Universite des Sciences et Techniques de Lille (France).

THE CONTRIBUTION OF TELEDETECTION TO THE CARTOGRAPHY OF THE FRENCH AGRARIAN COUNTRYSIDE [APPORTS DE LA TELEDECTION A LA CARTOGRAPHIE DES PAYSAGES AGRAIRES FRANCAIS]

J. Coudoux *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 103-116 refs In FRENCH (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

The French agrarian countryside was studied based on LANDSAT 1 and 2 image data. The research methods reviewed are visual approach and cartographic survey. The analysis of the agrarian elements and their components made possible the identification of criteria useful in the preliminary selection of raw data, but difficulties are yet foreseen for the choice of an automated selection system. Small scale cartography showing the agrarian countryside's structural features, is suggested.
Author (ESA)

N79-30625# Bureau de Recherches Geologiques et Minieres, Minieres, Paris (France).

EXAMPLES OF THE CONTRIBUTIONS OF TELEDETECTION TO MINING RESEARCH [ILLUSTRATION PAR L'EXEMPLE D'UN MODE D'APPUI ET D'INTERVENTION DE LA TELEDETECTION SPATIALE EN RECHERCHE MINIERE]

Jean-Yves Scanvic *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 117-131 refs In FRENCH (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

LANDSAT satellite images of mountainous regions of France were used to study geological structures in order to define the potential teledetection for mining research. Several dozen circular structures were discovered, ten of which are discussed as typical examples. It was also found that the alignments observed in the satellite images correspond to the phenomena described by Hobbs. The correlations with previous data show several possible origins for the circular structures. It is concluded that teledetection can be very important for mining research planning.
Author (ESA)

N79-30626# Institut Francais du Petrole, Rueil-Malmaison.

CONTRIBUTION OF LANDSAT IMAGES TO GEOLOGICAL PROSPECTING IN THE WESTERN MEDITERRANEAN REGION [CONTRIBUTION DES IMAGES LANDSAT A LA PROSPECTION GEOLOGIQUE DANS LES REGIONS DE LA MEDITERRANEE OCCIDENTALE]

E. Hilali (Min. de l'Energie et des Mines, Rabac, Morocco), A Demnati (Min. de l'Energie et des Mines, Rabac, Morocco), J. C. Rivereau, and B. Soulhol *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 133-140 refs In FRENCH (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

Several morphostructural studies were carried out using LANDSAT images in order to provide techniques complementary to other methods of geological research. A local example for the region of Palomares in the southeast of Spain shows a good correlation between the surface and subsurface geology and one interpretation of the contours. At a regional level, in the zone of the Gibraltararc, a simultaneous study of the contours on earth and of the sea bathimetry permitted the formulation of a coherent structural model. It is concluded that the study of the contours can be used to formulate these models.
Author (ESA)

N79-30627# Centre National d'Etudes Spatiales, Toulouse (France).
DETERMINATION OF THERMAL CYCLES FROM GEOSTATIONARY METEOROLOGICAL SATELLITES [DETERMINATION DE CYCLES THERMIQUES A PARTIRDE SATELLITES METEOROLOGIQUES GEOSTATIONNAIRES]
J.-C. Favard *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 141-143 In FRENCH (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

Multispectral scanning data from Meteosat (CITHARE) satellites were used to study thermal inertial in Africa. The satellite was used to collect information both on the evolution of the temperature and the incident energy at each point. A representation mode is explained and several real case examples are shown. Several conclusions regarding the validity of the proposed methods and the influence of the relative positions of the Sun, Earth, and satellite are discussed. Author (ESA)

N79-30628# Milan Univ. (Italy). Cattedra di Fisica Terrestre.
LANDSAT IMAGE ANALYSIS IN THE FIELD OF REGIONAL GEOLOGY: THE LIGURIAN ARC
C. M. Marino *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 147-153 refs Original contains color illustrations (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

Two geological research projects were undertaken in a test area located in northern Italy, using LANDSAT 2 satellite data. Landslide hazard detection was investigated based on the analysis of selected parameters from LANDSAT 2 images. Many landslide areas characterized by marine silts and clays were found along the northern Appennines range. The geological structures, with special references to linear phenomena, were studied in the selected zone. Unclassified lineaments (17%) were found and from a sample of eight measured in situ, six showed positive tectonic response. Author (ESA)

N79-30629# Centre d'Etudes Phytosociologiques et Ecologiques, Montpellier (France).
COMPATIBILITY BETWEEN MANIFESTED AND POTENTIAL NEEDS AND THE POSSIBILITIES OFFERED BY SPACEBORNE TELEDETECTION FOR MEDITERRANEAN DEVELOPING COUNTRIES [COMPATIBILITE ENTRE BESOINS EXPRIMES ET POTENTIELS ET POSSIBILITES OFFERTES PAR LA TELEDETECTION SPATIALE DANS LE CAS DES ZONES ARIDES DES PAYS EN VOIE DE DEVELOPPMENT DE LA REGION MEDITERRANEENNE]
Gilbert Long *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 155-160 refs In FRENCH (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

The conditions necessary to the compatibility of the possibilities offered by spaceborne teledetection with the inventory, evaluation, prevision, and monitoring needs of the zones being considered are examined. The discussion is based on results obtained from the ARZOTU program (LANDSAT, south of Tunisia). The technological, thematic, institutional, and financial problems are pointed out. Author (ESA)

N79-30630# European Space Research and Technology Center, Toulouse (France).
THE EARTH OBSERVATION PROGRAM OF THE EUROPEAN SPACE AGENCY
D. Lennertz and I. Pryke *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 163-176 (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

The earth observation program of the European Space Agency is reviewed. Activities in the fields of meteorology, climatology, geodesy, and remote sensing are covered. Several projects are described, including METEOSAT, SEOCS, BIRAMIS, SLALOM, LASSO, SONG and SPACELAB. Applications of spaceborne radar and microwaves for remote sensing are explained. A proposal for an European remote sensing satellite is discussed.
Author (ESA)

N79-30631# Centre National d'Etudes Spatiales, Toulouse (France).
THE SPOT PROGRAM [LE PROGRAMME SPOT]
M. Cazenave *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 177-185 In FRENCH (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

The earth satellite observation program 'SPOT' is a polyvalent system mounted on a multifunction platform which is adaptable to various payloads. The first mission is related to territory utilization, and will be implemented by a payload operating in the viable spectrum, consisting of two identical high resolution instruments. This first payload offers the possibility of observing any zone with an average delay of 2.5 days of latitudes higher than 45 deg and the possibility of obtaining stereoscopic images with an angle of about 30 deg with a delay of one day between both images. Author (ESA)

N79-30632*# National Aeronautics and Space Administration, Washington, D. C.
THE LANDSAT PROGRAM: THE PRESENT AND PROSPECTS
Ruth I. Whitman *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 187-195 refs (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01 CSCL 08B

The LANDSAT program is described and the benefits derived from it are pointed out. The successive LANDSAT launchings and its respective equipment are discussed. The earth's surface covering, the techniques of relaying the information to the ground, a description of the LANDSAT D system, a comparison between the multispectral scanner on LANDSAT C and the MSS on LANDSAT D, and information about the regions of the electromagnetic spectrum covered by LANDSAT C and LANDSAT D are discussed. Author (ESA)

N79-30633# Canada Centre for Remote Sensing, Ottawa (Ontario).
CANADA'S SURSAT PROGRAM
E. Shaw *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 197-201 refs (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

The Canadian Sursat program, its origins, purpose, and expected benefits are explained. The program seeks an experimental assessment of the feasibility of satellite surveillance to meet the civilian regulatory and monitoring requirements in the time frame 1980 to 2000. Preparations are under way to receive U. S. SEASAT-A satellite data at Shoe Cove, develop optical and digital radar processing equipment and to equip two aircraft with radar. A series of application experiments will be done from mid 1978 to late 1979. If there is sufficient merit in the satellite information system, a recommendation would then be made for participation in a joint international satellite program that would be operational in the late 1980's. Author (ESA)

N79-30634# Academy of Sciences (USSR), Moscow.
REMOTE SENSING IN THE USSR ACADEMY OF SCIENCES STUDIES, EXPERIMENTS, MAIN RESULTS, CURRENT OBJECTIVES
R. Z. Sagdeev, A. P. Kapitza, and Y. L. Ziman *In* ESA Earth

Observation from Space and Management of Planetary Resources May 1978 p 203-216 Original contains color illustrations (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

The earth remote sensing studies carried out in the USSR since 1969 are reviewed. Starting from the Salyut-1 initial experiment, aiming to develop the principles of multiband imagery, the USSR programs to study earth resources from space are detailed, including the INTERCOSMOS multi-national program, the multiband photographic survey carried out from the Soyuz 12 and 13 spacecrafts, the development of the MKF-6 multiband space camera and the MSP-4 multicamera synthesizing projector, the Soyuz-22 synthesized color images, and the RADUGA project among others. The applications, the equipment being used and the data processing are discussed. Several color synthesized photographic examples are shown. Author (ESA)

N79-30635# Geosat Committee, Inc., San Francisco, Calif.
GEOSAT PROGRAM 1978: FUTURE GEOLOGICAL REMOTE SENSING FROM SPACE
F. B. Henderson *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 217-224 refs (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

The Geosat committee's objectives and the Geosat program are explained. Formed in 1976, with the support of 100 exploration and engineering companies, the Geosat committee suggested the use of supplementary sensing systems to optimize geological remote sensing from space within the NASA LANDSAT program. The recommendations include the use of rock/soil sensitive spectral bands, worldwide high resolution film, LANDSAT compatible digital stereoscopic imaging data, and synthetic aperture radars. Some Geosat required data may become available from France's SPOT, Japan's EARTH, Germany's ARGUS and other non-US, earth remote sensing satellites. Author (ESA)

N79-30636# Ford Aerospace and Communications Corp., Houston, Tex.
AN APPLICATION PROCESSING SYSTEM FOR IMAGERY DATA
John L. Benson, Richard Schell, J. Denton Tarbet, Lewis Bradford, Frank David, Gordon Dickinson, Jim Murphy, and Robert F. Purnell *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 229-232 refs Prepared in cooperation with US Dept. of Agr., Houston (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

The design approach and system installation for a processing system to support crop inventory using LANDSAT data is presented. The application test system (ATS) is currently being used by the United States Department of Agriculture (USDA) to support performance evaluation of remote sensing technology against USDA information requirements. The ATS described satisfies the USDA requirements in a cost effective manner and represents a major step in the transfer of remote sensing technology to a user organization. Author (ESA)

N79-30637# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Nachrichtentechnik.
DIBIAS: THE DIGITAL IMAGE PROCESSING SYSTEM: SYSTEM DESIGN AND APPLICATIONS
P. Haberaecker (Fed. Inst. for Geosci. and Natural Resources, Hannover) *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 233-236 (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

The DIBIAS system is reviewed and some applications of image processing in the field of remote sensing are explained. The DIBIAS system is intended to be a research oriented image processing system. Very little training should allow the user to handle the system. Immediatly after processing, the user can see the results on a color TV screen. The DIBIAS software is structured into modules; input and output programs are separated from actual image processing and several programs can be run simultaneously. The DIBIAS system can be put to optimal use when the experimenter processes pre-selected data. For most of the programs a few minutes are necessary for processing a typical multispectral image of 512x512 pixels. Author (ESA)

N79-30638# Bundesanstalt fuer Geowissenschaften und Rohstoffe, Hannover (West Germany).
APPLICATION OF DIGITAL IMAGE PROCESSING MODULES TO LANDSAT SCENES FOR THEIR IMPROVEMENT AND GEOLOGICAL EVALUATION
P. Hoppe and K. A. Ulbricht *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 237-241 refs Prepared in cooperation with DFVLR, Oberpfaffenhofen, West Ger. (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

The application of DIBIAS (Digital Image Processing System) to geological questions and problems was tested using LANDSAT image tapes. It was possible to obtain multispectral ortho-images of large areas of the earth by using the two LANDSAT satellites. Images were taken repetitively in six to twelve day sequences at the same time in the morning. This allows combination and comparison of images from different orbits for geoscientific interpretation. Results for a test area in Morocco and another in Sudan are discussed. In Morocco, supervised and unsupervised classifications produced unsatisfactory results because the existing vegetation led to misinterpretation by changing and disturbing the spectral reflectance of the ground. Author (ESA)

N79-30639# Engins Matra, Velizy (France).
IMAGE DATA COMPRESSION BY SHAPE RECOGNITION AND CLUSTERING [COMPRESSION DES DONNEES IMAGES PAR RECONNAISSANCE DES FORMES ET CLUSTERING]
Gabriel Lowitz *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 243-250 refs In FRENCH (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

A process of image compression was developed applying the thematic extraction concept to small blocks instead of the entire image while using previously developed algorithms. The theoretical aspects of the problems, the compression process of pattern identifcation by the clustering algorithm, the compression coding, the pre-treatment and pre-compression, and the global compression performances are discussed. An efficient coding was developed, consisting of limiting the transmission by pixel to a two or three bits address (instead of eight) by reference to a list of patterns in dictionary form. The reconstruction to three bits results in negligible errors. Some examples are given.
Author (ESA)

N79-30640# Engins Matra, Velizy (France).
PRETREATMENT OF ONBOARD SIGNALS. STUDY ON THE IMPLEMENTATION OF AN IMAGE COMPRESSOR [PRETRAITEMENT DU SIGNAL A BORD: ETUDE DE LA MECANISATION D'UN COMPRESSEUR D'IMAGES]
A. Spiwack *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 251-253 refs In FRENCH (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

A compression algorithm for images, to be used in real time cabled logic data processing, is presented. The method consists of dividing the image in blocks of 256 pixels and then analyzing the statistics of the gray levels by histogram computation. Simple criteria permit the grouping of points in classes (clustering). Only the class averages and the numbers of the pixels belonging to a class are transmitted. The implementation of the compressor is described. Author (ESA)

N79-30641# Technische Universitaet, Hanover (West Germany). Inst. fuer Photogrammetrie.
CARTOGRAPHIC ASPECTS OF EARTH IMAGERY OBTAINED FROM SPACE
Gottfried Konecny *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 255-261 refs (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

Requirements related to the mapping of images obtained from space are discussed. The interest in space photograph application to cartography derives from their faster evaluation

vis a vis aerial photographs for the same area. Camera operations, as they are being planed for the Spacelab-1 experiment payload are expected to meet the requirements for 1:250,000 and marginally for 1:50,000 mapping with respect to planimetry and resolution. Correction of the geometric distortions of LANDSAT multi-temporal multi-sensor images is proposed, including a geometric accuracy analysis of LANDSAT MSS imagery. Several examples of corrected photographs are given. Author (ESA)

N79-30642# Institut Geographique National, Paris (France).
AUTOMATIC CARTOGRAPHY OF LINEAR OBJECTS [CARTOGRAPHIE AUTOMATIQUE DES OBJETS LINEAIRES]
S. Braconne, F. Brun, and B. Fourcade *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 263-267 refs In FRENCH (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

Two methods of automatic cartography of linear elements, taken from LANDSAT images, are presented. One method uses the topological parameters of the sub-assemblies of image textures, attempting to characterize each sub-assembly by its shapes while looking only for linear shapes. The other method is based on the fact that the shade of gray of each pixel belonging to a linear element presents a large deviation from the average shade of the neighboring pixels, thus identifying the linear element. Results show that the topological method is adequate for the automatic identification for the important linear elements, such as highways. The method of linear anomaly works well for smaller subjects, but the increase in number may not be desirable in some cases. Author (ESA)

N79-30643# Centre d'Etude Spatiale des Rayonnements, Toulouse (France).
UTILIZATION OF CLASSIFICATION ALGORITHMS FOR SPECTRAL AND TEXTURAL DATA IN THE STUDY OF AN AGRICULTURAL ZONE [UTILISATION D'ALGORITHMES DE CLASSIFICATION DES INFORMATIONS PECTRALES ET TEXTURALES POUR L'ETUDE D'UNE ZONE AGRICOLE]
T. LeToan, P. Cassirame, J. Quach, and M. Monchant *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 269-276 refs In FRENCH (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

Classification algorithms were used on multispectral band scanning images from LANDSAT satellites and aerial photography in order to identify crops. The satellite information was introduced after a preliminary study about the fields homogeneity, and the classification done using the texture notion was compared with the results from aerial images. Several classification algorithms were studied and multitemporal date were also considered. Results show that crop inventories are possible using multispectral classification of LANDSAT images. Introduction of multitemporal data improves the results. The best adapted classification method found is the pondered euclidian distance supervised method.
Author (ESA)

N79-30644# Strasbourg Univ. (France). Groupe de Recherches en Teledetection Radiometrique.
PROBLEMS IN ELECTROMAGNETIC REMOTE SENSING AND PRINCIPLES OF INTERPRETATION [PROBLEMATIQUE DE LA TELEDETECTION ELECTROMAGNETIQUE ET PRINCIPES DINTERPRETATION]
F. Becker *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 279-298 refs In FRENCH (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

The effect of the parameters that control the flow of radiation matter, and thermal energy on remote sensing are examined with the help of several existing models. The problems of interpretation of remote sensing data are related to the measurment method itself, to the difference between space-borne measurements and local measurements, and to theoretical difficulties in data processing. The importance of the theoretical interpretation models for the solution of these problems.
Author (ESA)

N79-30645# Technische Hogeschool, Delft (Netherlands).
THE INTERACTION OF VEGETATED AND BARE FIELDS WITH 3cm WAVELENGTH ELECTROMAGNETIC RADIATION. MODELING AND EXPERIMENT
E. P. W. Attema *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 299-304 refs (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

An experimental program of ground based short range scatterometry on bare and vegetated test fields planted with different types of crops and natural vegetations was carried out. The acquired data base consists of radar data at X-band frequencies using HH, VV, and HV polarization, accompanied by plant parameter measurements and measurements of soil moisture. These data are used for the evaluation of the potential of available space sensors for agricultural missions. Accomplishing these objectives effectively requires an understanding of the wave interaction with the object. This insight was obtained on the by carefully designed experiments and by modeling the wave interaction using the experimental data. A progress report is presented on the models that were checked against the measurements and the models that were constructed using the experimental results. Author (ESA)

N79-30646# Ecole Polytechnique Federale de Lausanne (Switzerland).
A STUDY OF SOIL HUMIDITY AND ITS VARIATIONS THROUGH REMOTE SENSING [ETUDE DE L'HUMIDITE DU SOL ET DE SA VARIATION PAR TELEDETECTION]
P. Meylan, A. Musy, and C. Morzier (Bern Univ., Switz.) *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 305-313 refs In FRENCH (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

Soil humidity was determined by analysis of grand radiancy and reflectance in the microwave frequency range in order to establish a quantitative evaluation of the upper soil layers. The variations of humidity with time were studied. The usefulness of a sun radiancy model is discussed. Radiometers set at the frequencies of 4.9, 10.5, 21, and 30 GHz along with a scatterometer set at 10.5 GHz were used as well as conventional soil analysis apparatus. The results show that humidity of the upper soil layers can be estimated by single or multiple regression from the emissivity data and that the time functions of radiometric measurements are consistent with those of soil humidity. No clear conclusions were obtained about the usefulness of application of the Burke and Paris sun emission model. Author (ESA)

N79-30647# Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.
DEPOLARIZATION OF RADAR RETURN FROM ROUGH SOIL SURFACE
H. Hirosawa, S. Komiyama, and Y. Matsuzaka *In* ESA Observation from Space and Management of Planetary Resources May 1978 p 315-318 refs (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

Radar backscatter from rough soil surface was measured at 9.0 GHz for cross-polarization (HV) as well as for like-polarization (HH). Analysis of the data shows that the cross-polarized radar return has a dependency of nearly gamm square, where gamma is the power reflection coefficient at a plane soil-air interface. This fact suggests that the main mechanics in producing cross-polar ized radar return from rough soil surface at X-band is multiple scattering at a soil-air interface. Furthermore, the measurement shows that cross-polarized return seems to have a promising capability of sensitive, remote detection of soil moisture. Author (ESA)

N79-30648# Institut National de la Recherche Agronomique, Paris (France). Bioclimatologie Research Dept.
THE RELATIONSHIP BETWEEN THE VEGETAL COVER REFLECTANCE AND ITS STRUCTURE, THE SUN ELEVATION, AND THE ANGLE OF VISION: MODELING PROSPECTIVES [RELATIONS EXISTANT ENTRE LA REFLECTANCE D'UN COUVERT VEGETAL ET SA STRUCTURE, LA HAUTEUR DU SOLEIL ET L'ANGLE DE VISEE: PERSPECTIVES DE MODELISATION]
R. Bonhomme, G. Guyot, and J. Riom *In* ESA Earth Observation

from Space and Management of Planetary Resources May 1978 p 319-326 refs In FRENCH (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

A mathematical model was developed to calculate the reflectance of a vegetal cover in a vertical direction. Comparisons between corn crop reflectance data and model calculations were made, showing good a agreement. The role played by the vegetal cover structure was analyzed. Directional reflectance measurements diverge considerably from Lambert's law. The difference is greater for the crops that present a regular upper surface. When the upper surface becomes irregular the reflectance indexes approach those of Lambert's law. The relationship between the reflectance indexes and the structure of the vegetal cover was not determined. Author (ESA)

N79-30649# Ecole Polytechnique, Palaiseau (France).
DETERMINATION OF THE SURFACE TEMPERATURE OF THE SEA FROM RADIOMETRIC MEASUREMENT IN TWO ATMOSPHERIC WINDOWS [DETERMINATION DE LA TEMPERATURE DE SURFACE DE LA MER A PARTIR DE MESURES RADIOMETRIQUES DANS DEUX FENETRES ATMOSPHERIQUES]
D. Imbault, N. A. Scott, and A. Chedin *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 321-333 refs In FRENCH (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

A parametric procedure for determining the temperature of the sea surface from differential radiometric measurements is presented. An ARIES (Surface Emission Infrared Radiation Analyzer) was employed using the atmospheric windows 10.5 to 12.5 and 7.9 to 9.6 micrometers. A set of computer programs were utilized (1) to extract spectroscopic data from data banks, (2) to compute the atmospheric transmission line by line with direct integration in altitude and in frequency, and (3) to calculate the radiancies (attenuated sun radiancy and atmospheric energy emission) from which the equivalent temperature, seen, by a spaceborne or airborne radiometer can be obtained. Computerized simulations were performed. Results show that the procedure is sufficiently simple for rapid computation of sea temperature, even for real-time operation. Author (ESA)

N79-30650# Centre National d'Etudes Spatiales, Toulouse (France).
UTILIZATION OF MULTISPECTRAL THERMOGRAPHY FOR LANDSCAPE ANALYSIS [UTILISATION DE LA THERMOGRAPHIE MULTISPECTRALE DANS L'ANALYSE DU PAYSAGE]
M. Guy, Y. Patoureaux, M. Supomo, and M. Vieillefosse *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 335-345 refs In FRENCH Original contains color illustrations (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

An airborne thermographic apparatus was developed to separate the effects of the emissivity and the temperature of the sun. After corrections for atmospheric perturbations, the spectral emissivity of the various ground objects was obtained. Two test flights were done utilizing three spectral bands and the resulting data was processed obtaining color synthesized photographs. The results show that the resultant estimated temperatures are close to the actual values. Suggestions for further improvment and applications are given. Author (ESA)

N79-30651# Universite des Sciences et Techniques de Lille (France). Lab. d'Optique Atmospherique.
ELIMINATION OF THE ATMOSPHERIC EFFECTS AND OPTIMIZATION OF AN INFRARED RADIOMETER, WITH ONE OR TWO CHANNELS, FOR MEASURING THE GROUND SURFACE TEMPERATURE [ELIMATION DE L'EFFET DE L'ATMOSPHERE ET OPTIMISATION DES BANDES SPECTRALES D'UN RADIOMETRE INFRAROUGE A UN OU DEUX CANAUX POUR LA MESURE DE LA TEMPERATURE DE SURFACE DES SOLS]
P. Y. Descamps and T. Phulpin *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 347-353 refs In FRENCH (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

Optimum bandpass of an infrared system used for determining soil surface temperatures was investigated. Minimization of the radiometric noise of the Sun and the mean square deviation of the errors due to atmospheric effects was considered. For a one channel system it was found that the optimum is the spectrum internal 8.2 to 12.5 micrometers, while the most use band is 10.5 to 12.5 micrometers. The two channel system allows for the attenuation of atmospheric effects but at the same time the radiometric noise is increased. The optimum band widths for the channel system is 8.2 to 12.2 micrometer and 7.4 to 8.2 micrometers. Author (ESA)

N79-30652# Lille Univ. (France). Lab. d'Optique Atmospherique.
CORRECTION FOR THE ATMOSPHERIC DIFFUSION EFFECTS ON REMOTE SENSING DATA [CORRECTION DE L'EFFET DE DIFFUSION ATMOSPHERIQUE POUR LESS DONNEES DE TELEDETECTION]
D. Tanre and M. Herman *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 355-360 refs In FRENCH (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

The luminance measured from space was analyzed as a function of ground reflectance, atmospheric transmission, and atmospheric reflectance. For sites with reflectivity close to Lambert's Law, and for round visibility reater than 5 km, it was found that the apparent reflectance measured form a satellite could be linearized as a function of (1) sun reflectance, (2) tabulated atmospheric functions, and (3) two parameters characterizing the atmospheric aerosol content. The absolute attainable precision was on the order of one percent for site reflectance. Signal polarization funishes complementary information which is yet to be studied. A possible application is to use the ultraviolet polarization as a factor indicating image quality as related to aerosol contaminants. Author (ESA)

N79-30653# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Optoelektronike.
MEASUREMENTS OF SPECTRAL CHARACTERISTICS OF NATURAL SCIENCES
R. Staetter and M. Schroeder *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 361-365 refs (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

The radiometric field measurement technique is presented. The instrumentation and equipment used in a mobil laboratory is described. In particular, the characteristics of the the Barnes 12-550 spectroradiometer and the Bendix scanner for visible/near infrared spectra are detailed. Examples of field measurements are given. The system can be used as a local check of remote sensing measurements as well as to determine reflection characteristics in the band 0.4 to 1.1 micrometers, valuable for interpretation of multispectral images. Author (ESA)

N79-30654# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Flugfunk und Mirkrowellen.
SEA-STATE MEASUREMENTS AND RADAR IMAGING FROM SPACELAB 1
F. Schlude, M. Kleintz, and M. Werner *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 369-375 refs (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

A microwave remote sensing experiment (MRSE) to be flown as part of the first Skylab payload is presented. The main experiment objectives are measuring the directional wave height spectrum of the sea surface and radar imaging of land surfaces. The instrumentation of MRSE is described. A survey about data processing on ground is included. Another experiment involving demonstration measurements by the two frequency method from a stationary platform is presented. After an introduction to the theory of the two frequency method, a description of the instrumentation is given. Results of The experiment are discussed. Author (ESA)

N79-30655# Technische Hogeschool, Delft (Netherlands).
RADAR REFLECTOMETRY IN THE NETHERLANDS: MEASUREMENT SYSTEM, DATA HANDLING, AND SOME RESULTS
M. K. Smit *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 377-387 refs (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

A general discussion of the reflection mechanism is offered to support the argument that it is necessary to average over a number of independent measurements in order to get an accurate measurement result. One way to get a number of independent measurements is to lock at a target at several system-frequencies. With this aim an FM-CW radar was used. The number of independent measurement samples gained in This way, however, is not sufficient, so the method is employed on a number of independent, statistically identical targets. The measurement procedure, which takes this requirement into account and yet allows for quick data collection, is discussed and the method of data storing and data handling is covered. Some measurement results are given to illustrate the method. Author (ESA)

N79-30656# Technical Univ. of Denmark, Lyngby. Inst. of Electromagnetics.
A RADIOMETER SYSTEM WITH HIGH ABSOLUTE ACCURACY
Niels Skou *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 389-394 refs (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

A multifrequency radiometer system including a conically scanning antenna was developed and manufactured. The system is designed for collecting glaciological and oceanographic data and is intended for airborne use. The radiometers, at 5, 17 and 34 GHz, are described with special emphasis on The methods and principles implemented to ensure the high absolute accuracy needed for oceanographic purposes. The noise-injection technique, utilized in radiometer system, yields high absolute accuracy provided that all the front and microwave components are enclosed in a temperature stabilized box kept at a temperature equal to the radiometric reference. A very accurate digital thermometer is used to monitor the temperatures of critical components and corrections to the radiometric data can be performed.
Author (ESA)

N79-30657# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France).
OPTICAL PROCESSOR FOR SYNTHETIC APERTURE RADAR [PROCESSEUR OPTIQUE POUR RADAR A OUVERTURE SYNTHETIQUE]
M. Laug and D. Leger *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 395-399 refs In FRENCH (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

The principle of optical processors is reviewed, showing the analogies with holography. Formulas are developed that can be used to develop specialized processors adapted to particular missions. The design of the optical processor for signal reception on the SEASAT satellite is described. It is concluded that optical processors are competitive with other techniques due to their ability to handle large rates of simultaneous data both in distance and azimuth. Author (ESA)

N79-30658# European Space Agency, Paris (France).
SYNTHETIC APERTURE RADAR DESIGN FOR EARTH OBSERVATION MISSIONS
D. Macoll and G. Dieterle *In its* Earth Observation from Space and Management of Planetary Resources May 1978 p 401-406 (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

The design of a synthetic aperture radar (SAR) for use in Earth Observation Satellite missions is discussed. After highlighting all weather capability, the basic concept of the SAR and the problem of image quality is reviewed. Several SAR systems are then described and an evaluation of current technological problems and limitations is given. A brief outline of the ESA activities in preparing SAR payloads for future missions is included. Author (ESA)

N79-30659# Saab-Scania, Linkoping (Sweden).
SURFACE ROUGHNESS MEASUREMENT BY RADAR ALTIMETRY
S. R. J. Axelsson *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 407-416 refs (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

The basic principles of radar altimetry applied to the measurement of surface roughness height are discussed. Both beam and pulse limited systems are treated. The pulse limited systems are attractive in spaceborne applications due to the moderate requirements on antenna size and attitude control. However, a much higher transmitted power must be generated than in the beam limited system, which also gives a more well defined sensitivity beam. The low average output power of conventional short-pulse radars can be overcome by using frequency modulated radars. Various types of FM radar altimeters are discussed including pulse compression technique. The possibility for using the range noise level as a measure of the roughness height in beam limited systems is pointed out. It is also shown that the distribution of The roughness height can be estimated by using the information of the fading envelope.
Author (ESA)

N79-30660# Heriott-Watt Univ., Edinburgh (Scotland).
THE REMOTE SENSING OF SURFACE ATMOSPHERIC PRESSURES: AN ACTIVE MICROWAVE SYSTEM
H. W. Lightfoot, D. A. Flower, C. Gatley, and G. E. Peckham *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 417-419 (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

A proposal is made for a microwave pressure sounder to determine surface atmospheric pressure by measurement of the integrated transmission of the atmosphere at several discrete frequencies in the wings of the oxygen absorption band. Pulses of microwave energy are transmitted vertically downwards from a space platform and reflected back from the ocean surface. The ratio of return signal strength to transmitted signal strength is a measure of the atmospheric transmission which is in turn a function of The atmospheric pressure. Measurements at several frequencies are required to eliminate the effects of clouds, changes in ocean surface reflectivity, etc. Since the total absorbing path must be known, the components of the signal reflected from clouds can be rejected. A power rating system operating at two frequencies around 55 GHz was built and is in use on a horizontal ground path as part of the feasibility study for the proposed space flight instruments. Results from this work are discussed.
Author (ESA)

N79-30661# European Space Research and Technology Center, Noordwijk (Netherlands).
SIGNAL PROCESSING ASPECTS OF SPACEBORNE SYNTHETIC APERTURE RADAR SYSTEMS
R. W. Okkes *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 421-428 (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

Signal processing aspects of active microwave systems used for remote sensing of the earth by satellites are discussed. After indicating the general objectives of remote sensing, an outline is given of the radar system concept presently envisaged by the European Space Agnecy to form part of the payload of a European earth resources satellite. The resulting spaceborne radar system is shown to require synthetic aperture techniques. The principle of operation is briefly explained. The speed and complexity of he processing operations are indicated and a challenging alternative option for performing the image generation in real-time using charge coupled devices technology is presented in some detail. Author (ESA)

N79-30662# Institut Geographique National, Paris (France).
STEREOSCOPY FROM SPACE [STEROSCOPIE SPATIALE]
A. Baudoin *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 431-440 refs In FRENCH (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

The applications of spatial stereoscopy are reviewed and

the experience obtained through the Apollo, Skylab, and LANDSAT missions is described. The technical problems associated with the type of sensor used in photogrammetry are examined. Other possible applications such as stereoradiometry, image interpretation, and pseudostereoscopy are mentioned. Uses of stereoscopy in future satellites are detailed. Author (ESA)

N79-30663# Centre National d'Etudes Spatiales, Toulouse (France).
OBLIQUE OBSERVATION BY AIRCRAFT OR SPACECRAFT [OBSERVATION OBLIQUE PAR AVION OU SATELLITE]
M. Vieillefosse *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 441-447 refs In FRENCH (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

The variation of the ground reflection coefficient with direction was studied. Data from aerial photography and multispectral scanning from space were analyzed concluding that the ground anisotropy depends on the nature of the surface, the relative position of the sun's azimuth, the observation wavelength, and the sun's elevation. The atmospheric contribution to the phenomenon is considered to be small. It is shown that bidirectional reflectance of the surfaces, and not only the albedo, must be considered. Applications to determine the sea roughness and the vegetation structure are discussed. Author (ESA)

N79-30664# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
USE OF A METRIC CAMERA IN SPACELAB
M. Schroeder and G. Konecny (Techn. Hochschule, Hannover) *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 449-454 refs (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

An experiment that will use a high resolution photogrammetric camera, to be included in the first Spacelab mission, to obtain metric quality photographs of the earth's surface is described. Improved satellite imagery is expected from this experiment as well as a demonstration of the use of photographs from space for mapping purpose. Objectives of the experiment, the camera system, the experiment parameters, and image quality are discussed. Author (ESA)

N79-30665# Academy of Sciences (USSR), Moscow. Inst. of Space Research.
ANALYSIS OF THE INFORMATIVE CHARACTERISTICS OF SCANNER AND PHOTO IMAGES OF THE EARTH'S SURFACE
V. V. Egorov, B. S. Zhukov, and V. A. Kottzov *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 455-464 (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

The analysis of images of the earth obtained from the Soyuz-22 spacecraft by means of the MKF-6 multispectral band camera is described. The analysis of brightness contrast was carried out using the method of pair sampling with frame to frame discretization, while the analysis of spectral contrast was done by central random sampling with frame to frame discretization. The important role played by the recording of the parameters of polarization of the radiation received is discussed, showing that remote indication of water surface oil pollution is one of the most promising applications. It is concluded that the degree of homogeneity of the fragments studied can be estimated.
Author (ESA)

N79-30666# Battelle Inst., Frankfurt am Main (West Germany).
REMOTE SENSING OF ATMOSPHERIC TRACE GASES BY DIFFERENTIAL ABSORPTION SPECTROSCOPY
W. Englisch and W. Wiesemann *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 465-473 refs Sponsored by DFVLR-BPT (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

A remote sensing system which is based on differential absorption measurements in the IR spectral region is described. The heart of the system is two tunable continuous wave CO2 lasers with their beams directed to the earth's surface and an optical superheterodyne receiver which detects and analyses the diffusely backscattered laser light. Fundamental spectroscopic data were provided by measuring the pressure-dependent absorption cross sections of relevant molecular gases for a set of discrete laser wavelengths. As a first step towards a spaceborne system, an airborne model was developed and successfully tried at flight altitudes from 300 m to 1200 m. By extrapolating the measured data it is concluded that the measuring range can be extended to Spacelab altitudes. Author (ESA)

N79-30667# Canada Centre for Remote Sensing, Ottawa (Ontario).
EXPERIMENT ON LANDSAT MSS HIGH GAIN MODE
Thomas T. Alfoeldi, Andrzej Sas-Uhrynowski (Inst. of Geodesy and Cartography, Warsaw), and Irena Majcher *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 475-481 refs (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

A comparative evaluation was conducted of LANDSAT MSS low and high gain imagery. High gain data has three times greater radiometric resolution for one-third of the radiometric range. While feature classification benefits minimally from the use of high gain data, significant improvements are expected for the identification of 'levels' or degrees of an environmental phenomenon, such as water depths, range of suspended solids concentration, and leaf areal coverage. Advantages in using high gain data also apply to the detection of sub-pixel size features and the analysis of targets under low illumination levels.
Author (ESA)

N79-30668# Office National d'Etudes et de Recherches Aeronautiques, Paris (France).
FAST INFRARED INTERFERENTIAL SPECTROMETER FOR THE SYSTEMATIC OBSERVATION OF SITES [SPECTROMETRE INTERFERENTIEL INFRAROUGE RAPIDE POUR L'OBSERVATION SYSTEMATIQUE DES SITES]
Georges Gauffre *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 483-488 ref In FRENCH (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

A Fourier transformation spectrometer, able to gather infrared spectral data on targets with near to ambient temperature, being sensitive to infrared between 3 and 12 micrometers in wavelength is described. Important characteristics of the instrument include a differential operating mode which compares with a reference black body and the feature of scanning the whole spectrum in 0.1 seconds. The interferometer is associated to an steerable telescope for observing distant targets. A minicomputer handles data acquisition and data processing. Results are furnished as the absolute value of spectral luminances. Author (ESA)

N79-30669# Thomson-CSF, Boulogne-Billancourt (France). Div. Tubes Electroniques.
CHARACTERISTICS AND UTILIZATION OF CHARGE TRANSFER PHOTOSENSITIVE RODS [CARACTERISTIQUES ET UTILISATION DES BARRETTES PHOTOSENSIBLES A TRANSFERT DE CHARGE]
Blamoutier and Descures *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 489-494 refs In FRENCH (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

Principles and construction of photosensitive rods built on a silicon substrate, capable of light intensity readings through a charge transfer mechanism, is described. The sensitivity spectral response, modulation transfer characteristics, and frequency response are examined as well as different possible functioning modes. The performance of two rods, having 512 and 1728 elements, respectively, is presented. The potential evolution of the performance of these devices, considering spaceborne applications, is discussed. Author (ESA)

N79-30670# Centre National d'Etudes Spatiales, Toulouse (France).
THE CHARGE TRANSFER DEVICES AND THEIR APPLICATIONS TO THE OBSERVATION OF THE EARTH [LES DISPOSITIFS A TRANSFERT DE CHARGES ET LEURS

APPLICATIONS A L'OBSERVATION DE LA TERRE]
Laporte *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 495-508 In FRENCH (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

Several techniques for the construction of photosensitive charge transfer devices are examined. Data on experimental measurements and performance are given and two instruments of this kind are described. Data on some charge transfer device characteristics are presented in table form. Examples of photographs taken in four spectral bands by the push broom 1728 camera are included. Author (ESA)

N79-30671# Centre National d'Etudes Spatiales, Toulouse (France).
HIGH RESOLUTION MULTISPECTRAL CAMERA [CAMERA MULTISPECTRALE A HAUTE RESOLUTION]
G. Otrio *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 509-515 In FRENCH (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

The specifications of the high resolution video to be included in the SPOT satellite mission, and the selection of techniques to meet these specifications are discussed. The instrument is composed of a seven lens dioptric telescope, a detector based on photosensitive charge transfer rods, and auxiliary mechanisms. It is concluded that the selection of a push broom type instrument has the greatest potential for this application because of its simplicity and performance. Author (ESA)

N79-30672# Societe Anonyme d'Etudes et Realisations Nucleaires, Limeil-Brevannes (France).
HIGH RESOLUTION CAMERA: INTERRELATION BETWEEN DETECTOR CONFIGURATION AND SPACECRAFT SYSTEMS [PRISE DE VUE A HAUTE RESOLUTION INTERRELATIONS ENTRE CONFIGURATION DES DETECTEURS ET SYSTEME SPATIAL]
A. Alouges, C. Pezant, and A. Semichon *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 517-519 In FRENCH (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

The interrelation between the detector configuration in the optical focal plane of a spaceborne high resolution camera and the attitude control and stabilization systems of a satellite is examined in order to determine optimization criteria for the detector configuration as a function of system constraints. Push broom scanning and scanning with integration and line charge transfer are studied. The advantages of the system with integration mainly in signal gain and signal to noise ratio due to the increase in exposure time, are pointed out. The constraints that this mode of operation impose on the spacecraft systems are discussed.
Author (ESA)

N79-30673# Centre National d'Etudes Spatiales, Toulouse (France).
SCANNING DEVICES FOR MEDIUM RESOLUTION CAMERAS IN THE VISIBLE AND INFRARED [DISPOSITIFS DE BALAYAGE POUR APPAREIL DE PRISE DE VUES MOYENNE RESOLUTION VISIBLE ET INFRAROUGE]
P. Vermande and G. Thomin *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 521-526 In FRENCH (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

The main characteristics of two kinds of scanning devices for medium resolution infrared video cameras are discussed. One is a wheel combined with a Schmidt telescope for scanning in the image space and the other is an oscillating mirror for scanning in the object space. The main advantage of the oscillating mirror is the reproducibility of the laws of motion. Further studies and experimentation with complete apparatus is recommended.
Author (ESA)

N79-30674# Barcelona Univ. (Spain). Dept. Termologia.
TECHNIQUE OF CALIBRATION ON REMOTE INFRARED SENSORS: APPLICATION TO OCEANOGRAPHIC PURPOSES
J. I. Jimenez, J. E. Llebot, C. Romeu-Nedwed (Inst. de Invest.), and A. Ballester (Inst. de Invest.) *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 527-532 refs Sponsored by Comm. Nacl. de Investigation del Espacio (CONIE) Original contains color illustrations (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

A calibration technique for an infrared remote sensing system on board a research aircraft is described. The equipment includes an infrared line scanner (IRLS) operating in the 8 to 14 micrometer range, a Barness precision radiometer thermometer (PRT), and Hasselblad cameras with infrared filters. For the sea data, a marine unit with in situ temperature sensing instrumentation continuously recorded sea surface temperature while a CASA 212 aircraft flew over it. The PRT data were used as a calibration for the IRLS. Both remotely sensed data from the IRLS, calibrated following our method, and sea information are in good agreement. Three examples are given: temperature pattern in front of a nuclear power plant; temperature pattern at the Ebro fan; determination and location of fresh water sources at the south of Peniscola. Author (ESA)

N79-30675# Centre d'Etudes et de Recherches Geodynamiques et Astronomiques, Grasse (France).
CALIBRATION, USING THE MOON, OF SATELLITE-BORNE INFRARED CAMERAS FOR EARTH OBSERVATION [CALIBRATION AU MOYEN DE LA LUNE DES INSTRUMENTS DE PRISE D'IMAGES INFRAROUGES EMBARQUES SUR SATELLITES D'OBSERVATION TERRESTRE]
J. Gay and G. Lebegue (Aerospatiale, Cannes, France) *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 533-540 refs In FRENCH (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

A feasibility study of calibration by means of the moon was done, for application on METEOSAT satellites, in order to compensate for the insufficiency of the internal calibration systems. Pyrometric calibration, based on pairs of temperature measurements taken on definite points on the moon by the satellite photometers, is discussed. The method will be tested on the first METEOSAT mission. Applications to other infrared earth observation satellites are foreseen. Author (ESA)

N79-30676# United Nations. General Assembly. Committee on the Peaceful Uses of Outer Space.
GLOBAL POLITICS: THE IMPACT OF SATELLITE TECHNOLOGY
Peter Jankowitsch *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 543-548 refs (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

The historical and organizational framework within which the international community has been attempting to cooperate in the peaceful uses of outer space is presented. The impact of satellite technology on global politics during the last two decades is stressed, in particular the rapid and widespread growth of remote sensing activities. A global remote sensing system is suggested, to be coordinated by the United Nations.
Author (ESA)

N79-30677# Centre National d'Etudes Spatiales, Paris (France).
UTILIZATION OF REMOTE SENSING DATA FOR CROP FORECASTING MODELS: ECONOMIC ADVANTAGES [UTILISATION DES DONNEES RECUEILLIES PAR TELEDETECTION POUR LES MODELES DE PREVISION DE RECOLTES: AVANTAGES ECONOMIQUES]
G. Fraysse, P. Mallet, and B. Susplugas *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 549-561 refs In FRENCH (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

Improvement of crop forecasting models by means of remote sensing data utilization was analyzed. The models studied include climatic regression models, agrometeorological models, and the bio-climatic and bio-structural models. The contributions of remote sensing data are discussed for each of these models. A specific example referring to a corn crop is presented. It is concluded that these models can be effectively improved by remote sensing

data and that definite cost advantages are attainable.
Author (ESA)

N79-30678# ECON, Inc., Princeton, N. J.
BENEFITS TO THE UNITED STATES FROM IMPROVED WORLDWIDE WHEAT CROP INFORMATION BASED ON LANDSAT SYSTEM OVERVIEW
Klaus P. Heiss *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 563-574 refs (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

The Earth Resources Survey and the LANDSAT Program of NASA, in particular, were the subject of an economic evaluation in 1974. Two case studies on the application of LANDSAT data to agriculture were conducted. The value of worldwide information improvements on wheat crops is measured in the context of world wheat markets. The benefits to the United States of public LANDSAT information on wheat crops are, on the average, 235 million dollars a year. Most of these benefits accrue directly to United States consumers in the form of lower average wheat prices; at the same time production efficiency gains accrue in providing for domestic and foreign demand. These benefits are those of a system with possibly as many as three operating spacecraft of the LANDSAT-D type. The benefits compare favorably with the annual system's cost of about 80 million dollars.
Author (ESA)

N79-30679# United Nations, New York, N. Y. Outer Space Affairs Div.
THE ECONOMIC IMPLICATIONS OF REMOTE SENSING FROM SPACE FOR THE DEVELOPING COUNTRIES
Adigun AdeAbiondum *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 575-583 refs (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

The prospects for the operational stutus of space programs and the impact of future space vehicles and sensors on the economy of the developing countries are examined. Many developing countries have been satisfied and encouraged with the results obtained to date from the analysis of the data (acquired by LANDSAT satellite) of their resources. Consequently, these countries are now actively seeking training opportunities for their nationals in the interpretation and utilization of space-acquired information on their land. Such an investment carries an added advantage of introducing new technology into their planning and development processes. However, the required scale of investment in a full development of the ground segment of this technology might be too taxing on the resourced of most of the developing countries: regional co-operation provides an alternative solution.
Author (ESA)

N79-30680# Canada Centre for Remote Sensing, Ottawa (Ontario).
BENEFITS OF SPACEBORNE REMOTE SENSING FOR OCEAN SURVEILLANCE
A. K. McQuillan and Donald J. Clough (Waterloo Univ.) *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 585-596 refs (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

Cost effectiveness and cost benefit studies were carried out by the Canada Center for Remote Sensing to assess the potential contribution and value of satellite data in meeting Canada's expanding ocean information requirements. The potential role of satellites as part of a network of platforms providing surveillance data including satellites, aircraft, data buoys, ships and coastal stations is discussed. Analysis indicates that, considering only Canadian and ocean areas of responsibility, a single surveillance satellite system (including ground data handling) would provide almost 10 times as much aerial coverage as an aircraft system having the same annual cost. Results of potential benefits studies of the effect of improved weather, ice, and sea state environmental information on offshore petroleum production and transportation, fishing, and coastal as well as offshore transport activities based on a scenario for growth rates in these activities are presented.
Author (ESA)

N79-30681# London Univ. (England). Faculty of Laws.
LEGAL IMPLICATIONS OF REMOTE SENSING FROM SPACE
B. Cheng *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 597-612 refs (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

The applicable principles of general international law and the relevant provisions in the four multilateral treaties relating to outer space drawn up through the United Nations are examined. It is found that the existing law allows free sensing from outer space, but this conclusion is qualified by pointing to three ways whereby states might be able to contain its consequences. An analysis of the proposals currently before the United Nations, which is working on a new international instrument to govern remote sensing from outer space, and a critical examination of the progress so far made are included.
Author (ESA)

N79-30682# Zentralstelle fuer Geo-Photogrammetrie und Fernerkundung, Munich (West Germany).
KEY EUROPEAN APPLICATIONS FOR SATELLITE REMOTE SENSING EXPERIMENTS WITH PRESENT SYSTEMS: REQUIREMENTS FOR OPERATIONAL APPLICATION
J. Bodechtel *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 613-626 refs (For primary document see N79-30613 21-43)
Avail: NTIS HC A99/MF A01

The application of earth observation satellites for obtaining accurate and up-to-date information for survey, planning, and monitoring on a regional as well as worldwide level is discussed. Based on European user requirements, operational monitoring from space and sensor specifications are examined. Examples are drawn from LANDSAT and Skylab data. Results show that three optical payload configurations are sufficient to meet the requirements cited. These include an optical payload for medium and high ground resolution to be used in evaluating land use, extractive resources, and agricultural needs. Another optical configuration, having medium ground resolution with high spectral resolution, is needed for monitoring coastal zones and water resources. Finally, an optical payload for coarse ground resolution can be used in oceanography and the observation of polar zones.
Author (ESA)

N79-30683# Army Construction Engineering Research Lab., Champaign, Ill.
BASIC ANALYTICAL MODEL FOR ENVIRONMENTAL IMPACT ASSESSMENT OF SURFACE WATER RESOURCES Final Report
Robert E. Riggins, V. Kothandaraman, and Bruce C. Goettel May 1979 41 p refs
(DA Proj. 4A7-62720-A-896)
(AD-A069977; CERL-TR-N-64) Avail: NTIS HC A03/MF A01 CSCL 08/8

This report discusses and provides user instructions for a computerized water quality model that will help satisfy the Army environmental planner's need for quantitative information on dissolved oxygen resources in a stream caused by new Army projects or activities. The information provided by output from this model will be useful for providing data for impacts on the dissolved oxygen content of a stream for a single-reach, single-point-source pollutant inflow situation with steady-flow conditions. Three subprograms within the model are used to calculate the impact of carbonaceous and nitrogenous waste discharges on the oxygen resources in a receiving water body, the ultimate biological oxygen demand and deoxygenation coefficients for both carbonaceous and nitrogenous waste discharges, and annual variations in temperature of a water body.
Author

N79-30684# Kentucky Geological Survey, Lexington. Dept. of Geology.
BLACK SHALE STUDIES IN KENTUCKY Annual Report, 1 Oct. 1977 - 30 Sep. 1978
W. H. Blackburn, comp. 1978 335 p refs
(Contract EY-76-C-05-5202)
(ORO-5202-T1) Avail: NTIS HC A15/MF A01

Black shale studies have focused on their geochemistry, stratigraphy, and subsurface characterization, and on the

compilation of an archive of cored material. Technical progress made in these areas are reported. In addition, two Master's theses prepared under the stratigraphic study project and one under the geochemical study project are included and are abstracted and indexed separately. DOE

N79-30685# Bendix Field Engineering Corp., Grand Junction, Colo.
HELICOPTER-ASSISTED RADIOMETRIC SURVEY OF THE DIXON ENTRANCE QUADRANGLE, ALASKA
W. A. Burgett and K. J. Krause Feb. 1979 11 p refs
(Contract EY-76-C-13-1664)
(GJBX-19(79)) Avail: NTIS HC A02/MF A01

Known uraniferous rocks at Bokan Mountain were well expressed radiometrically, and the type of survey conducted is capable of detecting similar geologic environments that might exist at the surface elsewhere in the quadrangle. No similar uraniferous environments were indicated, however. Strong radiometric (eU) anomalies were detected in a limestone terrane in which uranium is not generally expected to occur in anomalous concentrations. DOE

N79-30686# Department of Energy, Washington, D. C. Oil, Gas, Shale and In Situ Technology Div.
OFFICE OF NAVAL PETROLEUM AND OIL SHALE RESERVE. REPORT OF OPERATIONS, 1 OCTOBER 1978 Annual Report
Dec. 1978 50 p
(DOE/RA-0011) Avail: NTIS HC A03/MF A01

Total production for FY 1978 from Elk Hills averaged 119,138 barrels of oil per day (BOPD). The Government's share of this production was approximately 100,000 BOPD. During this period, the Government's share of production was sold at two crude oil sales. At year end, two rigs were active in the development of the Shallow Oil zone, six in the Stevens Zone, and one in the Carneros Zone. Earlier in the year, two additional rigs were utilized for drilling deep exploratory test wells. No new productive horizons were discovered. During FY 1978, production at Teapot Dome averaged 1,957 BOPD. All sales during FY 1978 were to one purchaser. Activities included continuation of a three-year surface hydrology study, completion of a seven-well corehole program initiated in FY 1977, and the implementation of another three-well corehole program. DOE

N79-30687# Oak Ridge National Lab., Tenn.
TECHNICAL ASPECTS OF THE RESOURCE CONSERVATION AND RECOVERY ACT UPON COAL COMBUSTION AND CONVERSION SYSTEMS
D. W. Weeter and M. P. Bahor Feb. 1979 76 p refs
(Contract W-7405-eng-26)
(ORNL/OEPA-10) Avail: NTIS HC A05/MF A01

An extensive literature review was conducted in order to evaluate the hazardous potential of the various solids; literature based leachate data were compared to inorganic drinking water standards. All processes studied, even under leaching conditions, have a hazardous potential. Two conventional steam generation facilities, which have electrostatic precipitators, but do not have sulfur removal, were used as case studies. In each case, RCRA should induce minimal technical and cost impact; the Federal Water Pollution Control Act and the Federal Clean Air Act may have potentially more future impact on these two plants than does RCRA; it is not certain that this conclusion holds for all conventional steam plants or that it holds for other processes. DOE

N79-30688# Department of Energy, Washington, D. C. Energy Information Administration.
BITUMINOUS COAL AND LIGNITE DISTRIBUTION, JANUARY - SEPTEMBER 1978
8 Jan. 1979 77 p
(DOE/EIA-0125/3-78) Avail: NTIS HC A05/MF A01

During January-September 1978, production of bituminous coal and lignite in the United States totaled 456 million tons; 448 million tons were shipped for consumption while 8 million tons were stockpiled. Of the total coal distributed in the first nine months of 1978 (Table 1), 422.6 million tons (94 percent) were delivered to consumers in the United States and 25.7 million tons (6 percent) were exported (9.1 million tons to Canada and 16.6 million tons to Mexico and destinations overseas). A summary of coal shipments by district of origin are summarized. Shipments by geographic division destinations are shown in tables. DOE

N79-30689# Oak Ridge National Lab., Tenn. Analytical Chemistry Div.
POLAR CONSTITUENTS OF A SHALE OIL: COMPARATIVE COMPOSITION WITH OTHER FOSSIL-DERIVED LIQUIDS
I. B. Rubin, N. A. Goeckner (University of Western Ill., Macomb), and B. R. Clark 1979 22 p refs Presented at the Oil Shale Symp., Denver, 26 Mar. 1979
(Contract W-7405-eng-26)
(CONF-790334-2) Avail: NTIS HC A02/MF A01

Similarities and differences in the polar portions of a variety of types of fossil fuel oils including oil from shale, from several coal liquefaction processes and from a mixture of natural petroleum crudes are described. Samples were fractionated by acid/base distribution as well as by gel partition chromatography which was then followed by acid/base distribution and adsorption chromatography. One subfraction of particular interest was that obtained from the hydrophilic fraction after gel partition chromatography, extracted into a neutral subfraction, and then eluted from an alumina column by methanol. This subfraction was not gas chromatographable, and was partially characterized by elemental analysis, NMR spectroscopy and infrared spectrophotometry. DOE

N79-30690# Los Alamos Scientific Lab., N. Mex.
DETERMINING THE DYNAMIC PROPERTIES OF DEVONIAN GAS SHALE
Bart Olinger 1979 11 p refs Presented at the 20th US Symp. on Rock Mech., Austin, Tex., 4-6 Jun. 1979
(Contract W-7405-eng-36)
(LA-UR-79-832; Conf-790606-2) Avail: NTIS HC A02/MF A01

Four techniques are used to characterize the response of Eastern Devonian gas shales to impulsive loading. First, the elastic moduli of the transverse, isotropic shales are measured. Then, tensile strengths are deduced from an examination of samples recovered from impacts with characterized plates. Third, shock velocities, release wave velocities and stress-strain paths are determined from measured stress wave histories at various depths in the shales. Finally, the pressure-volume relation for these shales are determined from shock velocity measurement to pressures as high as 80 GPa (800 kbars) using impacts from high-explosive driven metal plates. DOE

N79-30691# Department of Energy, Washington, D. C. Energy Information Administration.
ANALYSIS OF THE PRODUCTIVITY OF DOMESTIC PETROLEUM EXPLORATION ACTIVITIES
Jul. 1978 61 p
(DOE/EIA-0102/7) Avail: NTIS HC A04/MF A01

The recent decline in the productivity of domestic petroleum exploration activities is examined. Data are presented on the recent changes in the productivity of domestic exploration activities and an analysis is provided of a number of underlying economic relationships that are likely influencing the trends in exploration activity. There is suggested a research agenda whose purpose would be to discern the transitory effects that the sudden increases petroleum prices have had on exploration activities. It is concluded that a significant change in the price of crude oil and/or natural gas could influence the productivity of domestic exploratory drilling. Exploration productivity would be a function not only of the declining quality of drilling prospects, but also of the current (and expected future) price levels. DOE

N79-30692# Bayerische Akademie der Wissenschaften, Munich (West Germany).
DETERMINATION OF ASTRO-GEODETIC PLUMB LINE DEFLECTIONS AT PRIMARY TRIANGULATION POINTS IN GERMANY DURING THE PERIOD 1966 TO 1977 [DIE ASTROGEODAETISCHEN LOTABWEICHUNGSBESTIMMUNGEN DER ABTEILUNG 1 DES DEUTSCHEN GEODAETISCHEN FORSCHUNGSINSTITUTS AUF PUNKTEN DES DEUTSCHEN HAUPTDREIECKSNETZES IN DEN JAHREN 1966 BIS 1977]
Klaus Kaniuth and Klaus Stuber Deut. Geodaetische Komm.

1978 32 p refs In GERMAN; ENGLISH summary
(Ser-B-299; ISBN-3-7696-8530-X) Avail: NTIS HC A03/MF A01

Plumb line deflections are determined in order to accurately calculate triangulation networks on a reference ellipsoid, to determine geoids, and to perform 3 dimensional calculations. These deflections were obtained from astronomical latitude and longitude determinations with zeiss Ni 2 astrolabes at 27 points in the triangulation network of Southern Germany. Tables of results are given adjusting horizontal measurements at the earth's surface to the reference ellipsoid. Author (ESA)

N79-30693# Bayerische Akademie der Wissenschaften, Munich (West Germany).

DETECTION OF GROSS ERRORS IN PHOTOGRAMMATIC BLOCKS Ph.D. Thesis - Stuttgart Univ. [DIE SUCHE NACH GROBEN FEHLERN IN PHOTOGRAMMETRISCHEN LAGEBLOECKEN]

Wolfgang Foerstner Deut. Geodaetische Komm. 1978 98 p refs In GERMAN
(Ser-C/Diss-240; ISBN-3-7696-9295-0) Avail: NTIS HC A05/MF A01

Various methods and hypotheses for automatically detecting gross errors are analyzed. The Helmer transformation is introduced and extended to treat the problems posed. It is shown, with the help of a statistical method, that photogrammetric coordinates can be determined with a high degree of reliability with very little additional information. This method has the advantage over classical methods of permitting small coarse errors to be determined in addition to large coarse errors. Author (ESA)

N79-30694# Bayerische Akademie der Wissenschaften, Munich (West Germany).

EQUIVALENCE RELATIONS FOR EVALUATING GEODETIC MEASUREMENTS [AEQUIVALENZBEZIEHUNGEN FUER DIE AUSWERTUNG GEODAETISCHER MESSUNGEN]

Heinz-Guenter Baehr (Tech. Univ., Brunswick) Deut. Geodaetische Komm. 1978 61 p refs In GERMAN
(Ser-C/Diss-242; ISBN-3-7696-9297-7) Avail: NTIS HC A04/MF A01

Relations are developed in order to interpret geodetic data (networks, photogrammetric results, etc.) in a nonambiguous manner. The method employed is based on a weighting matrix, a coefficient matrix, and an observation vector and is suitable for computer processing. A certain number of unwanted unknowns are eliminated in the calculations, which take into consideration relevant correlations. The reliability and accuracy of the results obtained are analyzed and choice criteria established for ambiguous cases. Examples are given. Author (ESA)

N79-30695# Bayerische Akademie der Wissenschaften, Munich (West Germany).

THEORETICAL RESEARCH INTO THE ACCURACY OF THREE DIMENSIONAL POINT DETERMINATIONS OF THE EARTH'S SURFACE Ph.D. Thesis - Stuttgart Univ. [THEORETISCHE UNTERSUCHUNGEN UEBER DIE GENAUIGKEIT DER DREIDIMENSIONALEN TERRESTRISCHEN PUNKTBESTIMMUNG]

Max Mayer Deut. Geodaetische Komm. 1978 169 p refs In GERMAN
(Ser-C/Diss-245; ISBN-3-7696-9299-3) Avail: NTIS HC A08/MF A01

Improvements on three dimensional network determination are considered. It is shown that three-dimensional points can be accurately determined in various coordinate systems from distance measurements, angles of elevation, astronomical latitudes and longitudes, and perhaps some additional information about directions. Relations are established between observations and parameters to be calculated. Mathematical models are developed to overcome the height and refraction problem; they are analyzed from an error point of view. Studies show to what extent the number of observations can be reduced without sacrificing accuracy. Author (ESA)

N79-30696# Bayerische Akademie der Wissenschaften, Munich (West Germany).

A GEODETIC WORLD DATUM FROM TERRESTRIAL AND SATELLITE DATA Ph.D. Thesis - Bonn Univ. [EIN GEODAETISCHES WELTDATUM AUS TERRESTRISCHEN UND SATELLITEDATEN]

Bernd Eitschberger Deut. Geodaetische Komm. 1978 188 p refs In GERMAN
(Ser-C/Diss-245; ISBN-3-7696-9300-0) Avail: NTIS HC A09/MF A01

An analytical description of the earth's surface based on a reference ellipsoid is developed. The earth's gravitational field, deduced from measurements, is expressed as a potential series. Suitable adjustments enable an approximate description of the earth's surface to be obtained in terms of equipotential surfaces (quasi-geoids). An ellipsoid, which corresponds in both an overall and local manner to the earth's surface is then equated to these surfaces. The mathematical treatment of data leading to optimized parameters defining an axisymmetric or triple axed elipsoid is described. The accuracy obtainable with this method is critically examined. Author (ESA)

N79-30697# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Nachrichtentechnik.

CLASSIFICATION OF MULTISPECTRAL REMOTE SENSING DATA Ph.D. Thesis - Tech. Univ., Berlin

Peter Haberaecker Jul. 1978 135 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-571) Original contains color illustrations
(DLR-FB-77-72) Avail: NTIS HC A07/MF A01; DFVLR, Cologne DM 108,10

Different concepts pertinent to classification are defined and a mathematical model, subsequently derived, is described. Various classifiers are theoretically considered. A synthetic and a natural scene, taken from a multispectral aerial photograph, are used to test and illustrate the efficiency of the various classifiers. Results are compared and a performance criteria is evolved. Further algorithms are compared and a performance criteria is evolved. Further algorithms are evaluated for feature selection and computation of indices showing the priori quality of classification. Finally, an example within the context of regional planning is examined using the classification of multitemporal image data. Author (ESA)

N79-30698# Open Univ., Milton (England). Energy Research Group.

TROPHIC MODELS: WAS ELTON RIGHT?

Steven Cousins Oct. 1978 21 p Presented at 2d Intern. Congr. of Ecology, Jerusalem, Sep. 1978
(ERG-026) Avail: NTIS HC A02/MF A01

The Eltonian pyramid, relating populations of animals to their size distribution, is reconsidered as a mathematical model in ecosystem energetics. It is noted that, unlike Lindeman's trophic level model, Elton's model distinguishes between different entropy states, thus allowing for the classification of plants and detritus into different levels according to their particular structures. It is also suggested that Elton's model is useful for diversity and heterogeneity studies, providing a relationship with energetics. As an appendix, the entropy change associated with the scattering of a food resource in an ecosystem is calculated and found to be significant.

N79-30699# General Accounting Office, Washington, D. C. Community and Economic Development Div.

COLORADO RIVER BASIN WATER PROBLEMS: HOW TO REDUCE THEIR IMPACT

4 May 1979 149 p ref
(PB-295398/2; CED-79-11) Avail: NTIS HC A07/MF A01

The numerous water problems existing within the Colorado River Basin are described and the need for the States and the Federal Government to work together to solve these problems is discussed. GRA

N79-30700# Utah Water Research Lab., Logan.

INTEGRATING WATER RESOURCES AND LAND USE PLANNING

Jim Mulder, Kirk R. Kimball, Dean T. Larson, L. Douglas James, and Lance R. Roving Jan. 1979 121 p refs
(Contract DI-14-34-0001-5227)
(PB-293643/3; UWRL/P-79/01; W79-05408; OWRT-C-6279(5227)(1)) Avail: NTIS HC A06/MF A01 CSCL 13B

Information and recommendations were developed pertaining to the integrating of water resource and land use planning at a conceptual level. In the accomplishment of this goal, the report acts as a vehicle of information transfer to facilitate recognition of the interrelationships between land use and water resources planning by practitioners in both areas. GRA

N79-30701# General Accounting Office, Washington, D. C. Energy and Minerals Div.
UNIQUE HELIUM RESOURCES ARE WASTING: A NEW CONSERVATION POLICY IS NEEDED
7 Mar. 1979 116 p
(PB-293751/4; EMD-78-98) Avail: NTIS HC A06/MF A01 CSCL 05C

The loss of helium through the use of natural gas, its most economical source, is considered. Available alternatives to conserve helium are discussed. Continuing investment in helium dependent, energy related technologies is predicted to sharply increase demand after the year 2000. The present helium program is shown to be inadequate and in need of congressional legislation to establish Federal responsibility for conserving helium for national needs. GRA

N79-30702# South Dakota State Univ., Brookings. Water Resources Inst.
ANALYSIS AND DISSEMINATION OF WATER RESOURCES INFORMATION Completion Report, Feb. 1975 - Jan. 1977
Maurice L. Horton, John L. Wiersma, and Charles G. Carlson Feb. 1979 48 p refs
(Contract DI-14-31-0001-5042)
(PB-294540/0; W79-05792; OWRT-A-050-SDAK(1)) Avail: NTIS HC A03/MF A01 CSCL 02C

A computer assisted program was developed to process, summarize and map water resources data. The data banks used in the study were analyses of water for water quality performed in the Water Quality Laboratory, water resources survey data from state-wide and county sources, and water rights locations. Spatial maps illustrating the distribution and water quality and quantity parameters and data summaries were prepared for user agencies. The program is not confined to water resource data. Most field and laboratory data were collected and geographically located according to legal description (township and range). The developed program involves the transformation of geographical location of data sites by legal description into a latitude-longitude system. Once the transformation is completed, large volumes of data can be mapped or displayed using the computer assisted method. GRA

N79-30703# Arizona State Univ., Tempe. Dept. of Geology.
GEOLOGIC APPLICATIONS OF LANDSAT IMAGES IN NORTHEASTERN ARIZONA TO THE LOCATION OF WATER SUPPLIES FOR MUNICIPAL AND INDUSTRIAL USES Final Report
Elizabeth Babcock, Philip Briggs, Kenneth DeCook, Lock Ethridge, Kennith Foster, Charles Glass, and Robert Schowengerdt Apr. 1979 103 p refs Prepared in cooperation with Arizona Univ., Tucson and Arizona Water Comm., Phoenix
(Contract DI-14-34-0001-8060)
(PB-294816/4; W79-06164; OWRT-B-066-ARIZ(1)) Avail: NTIS HC A06/MF A01 CSCL 13B

Photolineaments of the entire northeast quadrant of Arizona were mapped from standard EROS Data Center false color LANDSAT composites. In addition, photolineaments were mapped using computer enhanced LANDSAT imagery of two intensive study sites. A third source of geologic structure data were existing large scale lineament maps derived from aerial photography of the study sites. Results indicate that LANDSAT imagery may be used to survey large areas for lineaments, and to cue the hydrogeologist to promising regions, which can then be mapped at aerial photography scales. GRA

N79-30704# National Environmental Satellite Service, Washington, D. C.
SATELLITES AS AN AID TO WATER RESOURCE MANAGERS
D. F. McGinnis, Jr., R. A. Scofield, S. R. Schneider, and C. P. Berg Apr. 1979 25 p refs Presented at Convention and Exposition of Am. Soc. of Civil Engr., Boston, 2-6 Apr. 1979
(PB-296048/2; NOAA-79040901; ASCE/Preprint-3486) Avail: NTIS HC A02/MF A01 CSCL 04B

Examples of satellite data applications to water resource problems are presented to draw attention to a current source of data often overlooked by water managers. Although spatial and temporal constraints exist, satellite data can contribute useful information toward solutions of mesoscale and macroscale water resource problems; e.g., areal snow cover determinations, river ice, flood extent, and short-term precipitation estimates. GRA

N79-30705# Texas Dept. of Water Resources, Austin.
VARIATIONS IN SPECIFIC YIELD IN THE OUTCROP OF THE CARRIZO SAND IN SOUTH TEXAS AS ESTIMATED BY SEISMIC REFRACTION
Gail L. Duffin and Glenward R. Elder Apr. 1979 65 p refs
(PB-294988/1; TDWR/R-229) Avail: NTIS HC A04/MF A01 CSCL 08H

Lateral variations in total porosity and specific yield in the Carrizo Sand outcrop in South Texas for refinement of data to be used in the Carrizo were estimated aquifer computer model. Seismic refraction surveys were made on the Carrizo outcrop to determine lateral variations in compressional wave velocities in the unweathered and unsaturated zone. These compressional wave velocities were used to estimate total porosity in the saturated zone. The total porosity was used to estimate the specific yield (effective or drainable porosity) of the saturated material through the use of empirical relationships. GRA

N79-30706# New Hampshire Univ., Durham. Water Resources Research Center.
UTILIZATION AND INTERPRETATION OF HYDROLOGIC DATA WITH SELECTED EXAMPLES FROM NEW HAMPSHIRE Completion Report
Francis R. Hall and S. Lawrence Dingman Mar. 1979 102 p refs
(Contract DI-14-31-0001-4029; OWRT Proj. A-040-NH(2))
(PB-295393/3; RR-20; W79-06502) Avail: NTIS HC A06/MF A01 CSCL 08H

Examples are given of various ways of manipulating and interpreting stream flow data. Data sources and useful works available in the hydrology literature are discussed including the basic elements of frequency analysis. A detailed description of how to synthesize flow duration curves for upgaged areas is provided along with an application of a regional flood analysis, mainly by graphical methods. Examples of the use of regression analysis are included. GRA

N79-30707# National Technical Information Service, Springfield, Va.
REMOTE SENSING OF THE OCEAN. VOLUME 2, PART 1: PHYSICAL, CHEMICAL, AND GEOLOGICAL PROPERTIES, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1976 - May 1979
Robena J. Brown Jun. 1979 107 p Supersedes NTIS/PS-78/0563; NTIS/PS-77/0532; NTIS/PS-76/0468; NTIS/PS-75/446
(NTIS/PS-79/0585; NTIS/PS-78/0563; NTIS/PS-77/0532; NTIS/PS-76/0468; NTIS/PS-75/446) Avail: NTIS HC $28.00/MF $28.00 CSCL 08J

Studies on remote sensing methods as they apply to ocean temperature, sea ice, marine biology, and sound and light transmission are described. (This updated bibliography contains 99 abstracts, 24 of which are new entries to the previous edition). GRA

N79-30708# National Technical Information Service, Springfield, Va.
REMOTE SENSING OF THE OCEAN. PART 2: DYNAMICS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1970 - May 1979
Robena J. Brown Jun. 1979 172 p Supersedes NTIS/PS-78/0564; NTIS/PS-77/0533; NTIS/PS-76/0469; NTIS/PS-75/447
(NTIS/PS-79/0586; NTIS/PS-78/0564; NTIS/PS-77/0533; NTIS/PS-76/0469; NTIS/PS-75/447) Avail: NTIS HC $28.00/MF $28.00 CSCL 08J

Studies on remote sensing methods as they apply to ocean

currents, wind sediment transport, ocean waves, sea states, and water interactions are presented. The various techniques of measurement are described. (This updated bibliography contains 166 abstracts, 23 of which are new entries to the previous edition). GRA

N79-30709# HRB-Singer, Inc., State College, Pa.
INVESTIGATION OF COLOR AND COLOR INFRARED AERIAL PHOTOGRAPHIC TECHNIQUES FOR MINING AND RECLAMATION PLANNING AND MONITORING Open File Report, 30 May 1975 - 28 Apr. 1978
William M. Knuth, Eric L. Fritz, and James A. Schad 29 Sep. 1978 215 p refs
(Contract DI-BM-JO-155041)
(PB-294707/5; HRB-4936-F; BM-OFR-37-79) Avail: NTIS HC A10/MF A01 CSCL 08I

The technical and economical feasibility of using color and color infrared aerial photography to satisfy some informational needs for premine planning, mine progress monitoring, and reclamation monitoring was evaluated. Interpretability accuracies were also evaluated for parameters in the broad categories of land use, soils, water, vegetation, and geology. Seasonal interpretation characteristics were noted for infrared photography. Man hours for photointerpretation and costs of aerial data collection were monitored closely and incorporated into a cost benefit analysis. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N79-30710 California Univ., Berkeley.
ENERGY AND MATERIALS IN THREE SECTORS OF THE ECONOMY: A DYNAMIC MODEL WITH TECHNOLOGICAL CHANGE AS AN ENDOGENOUS VARIABLE Ph.D. Thesis
Alfred Linden Levinson 1978 168 p
Avail: Univ. Microfilms Order No. 7914673

One of the major difficulties encountered when modelling the demand for energy and resources is the lack of an adequate method for introducing technological change into the model. Embodied technological change and its effect on the technical coefficients of input-output models is examined. The recursive programming method is used to dynamically model embodied technological change in three industries, steel, aluminum, and can manufacturing. The method is composed of two phases, the static and the recursive or dynamic. The static or short run phase uses a linear program to optimize production by the various technologies. The dynamic phase consists of an econometric submodel where the level of investment in the technologies, the marginal cost of the technologies, the supply of some of the material inputs, and the demand for the output of the industries are determined. Dissert. Abstr.

N79-30711*# Hughes Aircraft Co., El Segundo, Calif. Space and Communications Group.
IMPROVEMENT AND EXTENSION OF DATA FROM ATS-6 SOLAR CELL RADIATION DAMAGE EXPERIMENT (SCRDE) Final Report, 10 May - 31 Dec. 1978
Leland J. Goldhammer Mar. 1979 49 p refs
(Contract NAS5-24458)
(NASA-CR-159949) Avail: NTIS HC A03/MF A01 CSCL 10A

The ATS 6 solar cell radiation damage experiment data through 2 1/3 years of synchronous orbit operation are presented. Comparisons are made of the performances of the 13 different types of solar cell/cover configurations, including solar cell and cover thickness variations, base resistivity variation, new cover processes and materials, and the COMSAT violet cell. These performances are also compared to the performance of the LES 6 solar cell experiment, the ATS 6 main solar arrays, and laboratory spectrum electron irradiations. It is found that the cells of the ATS 6 experiment generally performed as expected through 6 to 9 months in orbit, but that at 2 1/3 years they were severely degraded in current. The short circuit current degradation after 2 1/3 years in orbit appears to exhibit an anomalous additional degradation of 5 to 9 percent over what was experienced in synchronous orbit operation. A.W.H.

N79-30712*# Miami Univ., Coral Gables, Fla. Dept. of Mechanical Engineering.
DETERMINATION OF POTENTIAL SOLAR POWER SITES IN THE UNITED STATES BASED UPON SATELLITE CLOUD OBSERVATIONS Final Report, 5 Jun. 1975 - 4 Sep. 1977
H. W. Hiser, H. V. Senn, S. T. Bukkapatnam, and K. Akyuzlu Dec. 1977 47 p refs
(Contract NAS5-22417)
(NASA-CR-159944) Avail: NTIS HC A03/MF A01 CSCL 10B

The use of cloud images in the visual spectrum from the SMS/GOES geostationary satellites to determine the hourly distribution of sunshine on a mesoscale in the continental United States excluding Alaska is presented. Cloud coverage and density as a function of time of day and season are evaluated through the use of digital data processing techniques. Low density cirrus clouds are less detrimental to solar energy collection than other types; and clouds in the morning and evening are less detrimental than those during midday hours of maximum insolation. Seasonal geographic distributions of cloud cover/sunshine are converted to langleys of solar radiation received at the earth's surface through relationships developed from long term measurements at six widely distributed stations. A.W.H.

N79-30713# Hittman Associates, Inc., Columbia, Md.
COMPREHENSIVE COMMUNITY ENERGY PLANNING. VOLUME 2: APPENDICES
Nov. 1978 229 p refs 2 Vol.
(Contract EC-77-C-10-0023)
(HCP/M0023-02-Vol-2) Avail: NTIS HC A11/MF A01

Energy saving strategies and components for energy conservation in cities and residential areas are presented. Estimates for alternative energy saving measures are discussed in areas of land use, mass transit, and building modifications. Energy conservation plans in these areas, such as tax credits and loans, are discussed and estimation methods are described. A.W.H.

N79-30714*# SRI International Corp., Menlo Park, Calif.
NOVEL DUPLEX VAPOR-ELECTROCHEMICAL METHOD FOR SILICON SOLAR CELLS Quarterly Progress Report, 1 Feb. - 31 Apr. 1979
L. Nanis, A. Sanjurjo, K. Sancier, R. Bartlett, and S. Westphal 25 Jun. 1979 23 p
(Contracts NAS7-100; JPL-954471; SRI Proj. PYU-4980)
(NASA-CR-162113; ERDA/JPL-954471-79/10; QPR-13) Avail: NTIS HC A02/MF A01 CSCL 10A

The dependence of the SiF4 Na reaction initiation time and of the efficiency of the reaction on Na particle size and reaction temperature were studied. Close to 100 percent utilization of Na was obtained, and formation of byproduct fluoro-silicate was decreased to below 10 percent. A SiF4 Na reactor was built to scale up the reaction by a factor of about four and is now being tested. A scaled up melting system was built and successfully used to separate Si from kilogram quantities of SiF4 NaF mixtures. Support studies of the volatilization of NaF performed in a smaller melting system indicated minimal loss of NaF as vapor at 1410 C. The wetting of graphite was also investigated to determine the constituents of the NaF phase which promote good wetting. A.W.H.

N79-30715*# Wyle Labs., Inc., Huntsville, Ala. Solar Energy Systems Div.
INDOOR TEST AND LONG-TERM WEATHERING EFFECTS ON THE THERMAL PERFORMANCE OF THE SOLAR ENERGY SYSTEM (LIQUID) SOLAR COLLECTOR
May 1979 41 p refs Prepared for DOE
(Contract NAS8-32036)

(NASA-CR-150794; WYLE-TR-531-23) Avail: NTIS HC A03/MF A01 CSCL 10A

The procedures used and the results obtained during the evaluation test program on a liquid solar collector are presented. The narrow flat plate collector with reflective concentrating mirrors uses water as the working fluid. The double-covered collector weighs 137 pounds and has overall dimensions of about 35' by 77' by 6.75'. The test program was conducted to obtain the following information: thermal performance data under simulated conditions, structural behavior under static load, and the effects of long term exposure to natural weathering. K.L.

N79-30716*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CHARACTERIZATION OF SOLAR CELLS FOR SPACE APPLICATIONS. VOLUME 6: ELECTRICAL CHARACTERISTICS OF SPECTROLAB BSF, BSR, TEXTURED, 10 ohm-cm, 50 MICRON ADVANCED OAST SOLAR CELLS AS A FUNCTION OF INTENSITY, TEMPERATURE, AND IRRADIATION

B. E. Anspaugh, R. G. Downing, T. F. Miyahira, and R. S. Weiss 15 Jun. 1979 44 p refs
(Contract NAS7-100)
(NASA-CR-162109; JPL-Pub-78-15-Vol-6) Avail: NTIS HC A03/MF A01 CSCL 10A

Electrical parametric data are presented on BSF, BSR, textured 10 ohm cm, 50 micron advanced OAST cells in graphical and tabular form as functions of solar Illumination intensity, temperature, and 1 MeV electron fluence. R.E.S.

N79-30717*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CHARACTERIZATION OF SOLAR CELLS FOR SPACE APPLICATIONS. VOLUME 7: ELECTRICAL CHARACTERISTICS OF SPECTROLAB HEWAC BSF, TEXTURED, 10 ohm-cm, 225 MICRON SOLAR CELLS AS A FUNCTION OF INTENSITY AND TEMPERATURE

B. E. Anspaugh, D. M. Beckert, R. G. Downing, T. F. Miyahira, and R. S. Weiss 15 Jun. 1979 38 p refs
(Contract NAS7-100)
(NASA-CR-152110; JPL-Pub-78-15-Vol-7) Avail: NTIS HC A03/MF A01

Electrical characteristics of Spectrolab HEWAC BSF, textured, 10 ohm cm, 225 micron solar cells are presented in graphical and tabular format as a function of solar illumination intensity and temperature. Author

N79-30718*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THERMAL POWER SYSTEMS SMALL POWER SYSTEMS APPLICATIONS PROJECT. VOLUME 2: DETAILED REPORT Annual Technical Report, Fiscal Year 1978

A. T. Marriott 15 Jan. 1979 212 p
(Contract NAS7-100; JPL Proj. 5103-36)
(NASA-CR-162104; JPL-Pub-79-43-Vol-2; DOE/JPL-1060-9) Avail: NTIS HC A10/MF A01 CSCL 10B

Small power system technology as applied to power plants up to 10 MW in size was considered. Markets for small power systems were characterized and cost goals were established for the project. Candidate power plant system design concepts were selected for evaluation and preliminary performance and cost assessments were made. Breakeven capital costs were determined for leading contenders among the candidate systems. The potential use of small power systems in providing part of the demand for pumping power by the extensive aqueduct system of California, was studied. Criteria and methodologies were developed for the ranking of candidate power plant system design concepts. Experimental power plant concepts of 1 MW rating were studied to define a power plant configuration for subsequent detail design construction, testing and evaluation. Site selection criteria and ground rules were developed. K.L.

N79-30719*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
WIND TURBINES FOR ELECTRIC UTILITIES: DEVELOPMENT STATUS AND ECONOMICS

J. R. Ramler and R. M. Donovan 1979 21 p refs Presented at Terrest. Energy Systems Conf., Orlando, Fla., 4-6 Jun. 1979; sponsored by AIAA
(Contract E(49-26)-1028)
(NASA-TM-79170; E-035; DOE/NASA/1028-79/23) Avail: NTIS HC A02/MF A01 CSCL 10B

The technology and economics of the large, horizontal-axis wind turbines currently in the Federal Wind Energy Program are presented. Wind turbine technology advancements made in the last several years are discussed. It is shown that, based on current projections of the costs of these machines when produced in quantity, they should be attractive for utility application. The cost of electricity (COE) produced at the busbar is shown to be a strong function of the mean wind speed at the installation site. The breakeven COE as a fuel saver is discussed and the COE range that would be generally attractive to utilities is indicated. Author

N79-30720*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE CHARACTERISTICS OF A SLAGGING GASIFIER FOR MHD COMBUSTOR SYSTEMS Final Report

Kenneth O. Smith Jun. 1979 49 p refs Sponsored in part by DOE
(Contract EF-77-A-01-2674)
(NASA-TM-79195; E-072; DOE/NASA/2674-79/6) Avail: NTIS HC A03/MF A01 CSCL 10A

The performance of a two stage, coal combustor concept for magnetohydrodynamic (MHD) systems was investigated analytically. The two stage MHD combustor is comprised of an entrained flow, slagging gasifier as the first stage, and a gas phase reactor as the second stage. The first stage was modeled by assuming instantaneous coal devolatilization, and volatiles combustion and char gasification by CO2 and H2O in plug flow. The second stage combustor was modeled assuming adiabatic instantaneous gas phase reactions. Of primary interest was the dependence of char gasification efficiency on first stage particle residence time. The influence of first stage stoichiometry, heat loss, coal moisture, coal size distribution, and degree of coal devolatilization on gasifier performance and second stage exhaust temperature was determined. Performance predictions indicate that particle residence times on the order of 500 msec would be required to achieve gasification efficiencies in the range of 90 to 95 percent. The use of a finer coal size distribution significantly reduces the required gasifier residence time for acceptable levels of fuel use efficiency. Residence time requirements are also decreased by increased levels of coal devolatilization. Combustor design efforts should maximize devolatilization by minimizing mixing times associated with coal injection. K.L.

N79-30721*# Clarksville Community School Corp., Ind.
SOLAR ENERGY RETROFIT FOR CLARKSVILLE MIDDLE SCHOOL, CLARKSVILLE, INDIANA

Aug. 1979 126 p Sponsored in part by NASA
(Contract EG-77-A-01-4076)
(NASA-CR-161272) Avail: NTIS HC A07/MF A01 CSCL 10A

The solar energy retrofit heating system installed to provide heating for two gymnasiums at the Clarksville Middle School located in Clarksville, Indiana is described in detail. The system type is hot water using existing chilled water piping and chilled water coils in an air handler system. Flat plate, single-glazed selectively coated solar collectors were installed on the roof of each gymnasium. Total collector area covers 6,520 square feet. The liquid is stored in a 10,000 gallon steel tank installed below grade. Author

N79-30722# Hittman Associates, Inc., Columbia, Md.
COMPREHENSIVE COMMUNITY ENERGY PLANNING. VOLUME 1: A WORKBOOK

Nov. 1978 147 p refs 2 Vol.
(Contract EC-77-C-10-0023)
(HCP/M0023-01-Vol-1) Avail: NTIS HC A07/MF A01

The project resulted in the development of a methodology and workbook which enables community officials and staff to develop and evaluate energy conservation programs for their community. This methodology is a pioneering effort in the field of community energy planning. As such, many of the procedures generated were not subjected to test and evaluation in actual communities. In an effort to validate the procedures presented, the U.S. DOE is sponsoring a test and demonstration of this methodology in various selected communities. Based upon

the results of these demonstrations, the procedures may require refinement to more accurately reflect actual community needs. G.Y.

N79-30723# Department of Energy, Washington, D. C. Div. of Industrial Applications and Commercialization.
OVEN CURING: ENERGY CONSERVATION AND EMISSION CONTROL IN COIL COATING
1978 33 p Original contains color illustrations
(TID-28705) Avail: NTIS HC A03/MF A01

An energy saving system is presented which recovers heat from the exhaust streams of coil curing ovens. A zone incinerator is retrofitted to the curing ovens to recover and recycle the significant portions of energy lost in the curing process. This reduces the natural gas consumption in the ovens by 74% and the solvent emission by 40 to 60%. The performance and economics of this system are surveyed. A.W.H.

N79-30724# Goodyear Atomic Corp., Piketon, Ohio.
REFRIGERANT-114 RANKINE CYCLE ENERGY RECOVERY TECHNOLOGY FROM THE GASEOUS DIFFUSION INDUSTRY
Clair O. Langerbbrake 8 Sep. 1978 39 p refs
(Contract EY-76-C-05-0001)
(GAT-916) Avail: NTIS HC A03/MF A01

An unclassified accounting of energy recovery technology developed in the gaseous diffusion (uranium enrichment) industry during the past twenty years is presented. This spin-off knowledge may be of value to those in industry seeking to reduce operating costs while meeting the national objective of conserving energy. Four Rankine cycle energy recovery installations using Refrigerant-114 (R-114) as the working fluid are described, and the conclusions drawn from their operation are given. In all these installations, energy was extracted from waste heat by using R-114 vapor to drive expansion turbines connected to compressor motor shafts. This arrangement resulted either in reducing the electric load on the motor, or, if the motor could be overdriven to act as a generator, in returning electric power to the plant electrical grid. Factors significant in the design of these energy recovery systems, as well as economic and design considerations that may be significant in applications in other industries, are discussed. The following topics are included: the selection of suitable system controls; the superiority of R-114 to steam as the working fluid in some energy recovery systems; the advantages and disadvantages of different turbine types; the uses and limitations of positive contact seals in refrigerant systems; and methods of enhancing energy recovery, such as tracking ambient conditions and using countercurrent flow cooling. F.O.S.

N79-30725 Committee on Energy and Natural Resources (U. S. Senate).
SOLAR PHOTOVOLTAIC ENERGY RESEARCH, DEVELOPMENT, AND DEMONSTRATION ACT OF 1978
Washington GPO 1978 116 p refs Hearing on S. 3392 and H.R. 12874 before the Subcomm. on Energy Res. and Development of the Comm. on Energy and Natural Resources, 95th Congr., 2d Sess., 19 Sep. 1978
(GPO-36-187; Publ-95-167) Avail: Subcomm. on Energy Res. and Development

Testimony was given and arguments were heard on a bill and an act to provide for an accelerated program of research, development, and demonstration of solar photovoltaic energy technologies leading to early competitive commercial applicability of such technologies to be carried out by the Department of Energy, with the support of NASA, the National Bureau of Standards, the General Services Administration, and other federal Services agencies. M.M.M.

N79-30726 Committee on Energy and Natural Resources (U. S. Senate).
SOLAR POWER SATELLITE RESEARCH, DEVELOPMENT, AND DEMONSTRATION PROGRAM ACT OF 1978
Washington GPO 1978 270 p refs Hearing on S. 2860 and H.R. 12505 before the Subcomm. on Energy and Natural Resources, 95th Congr., 2d Sess., 14 Aug. 1978
(GPO-35-994; Publ-95-166) Avail: Subcomm. on Energy Res. and Development

Satellite solar energy conversion transmission to earth to generate electricity for domestic purposes is studied. A space orbiting mirror system designed to provide continuous and slightly concentrated reflected solar energy to selected solar conversion sites is examined. Development of this system is discussed through economic viability, design feasibility, and energy storage and conversion techniques. A.W.H.

N79-30727# Illinois Univ. at Urbana-Champaign. Energy Research Group.
ENERGY AND LABOR INTENSITIES PROJECTED TO THE YEAR 2010
Bruce Hannon and Andrew R. Pleszkun DoE Sep. 1978 163 p refs
(Contract EM-78-S-02-4628)
(COO-4628-2) Avail: NTIS HC A08/MF A01

Total (direct and indirect) energy and labor intensities were projected to the year 2000 for a 40-sector economy. Energy intensities were derived by modifying the CONAES results with four possible energy price change scenarios between 1975 and 2010. Labor intensities were projected using data from the CAC model and projected BLS materials to approximate the effect of a doubling of energy prices between 1975 and 2010. As an example, the projected data were used to determine the net energy and employment impacts of the National Energy Plan on residential energy use to the year 2000. K.L.

N79-30728# Brookhaven National Lab., Upton, N. Y.
FUEL CELLS: APPLIED RESEARCH FUEL CELL MATERIALS AND ELECTROCATALYSIS Annual Report, 1 Jan. - 31 Dec. 1977
S. Srinivasan, H. S. Isaacs, W. E. Ogrady, P. G. Russell, H. Olender, C. R. Davidson, L. J. Olmer, and A. C. C. Tseung Dec. 1978 39 p refs
(Contract EY-76-C-02-0016)
(BNL-50951) Avail: NTIS HC A03/MF A01

The electrocatalysis of fuel cell reactions is examined with emphasis on the inhibition of sintering of fuell cell catalyst particles, electrochemical methods for surface regeneration, and the use of oxides as oxygen electrodes. Overpotentials in solid electrolyte fuel cells are analyzed and methods for the selection and evaluation of interconnector materials are discussed. A.R.H.

N79-30729# Comptroller General of the United States, Washington, D.C.
IMPROVED ENERGY CONTINGENCY PLANNING IS NEEDED TO MANAGE FUTURE ENERGY SHORTAGES MORE EFFECTIVELY
10 Oct. 1978 65 p
(EMD-78-106) Avail: NTIS HC A04/MF A01

The Federal, State, and Industry efforts in preparing for coping with energy emergencies are reported. The development and accuracy of the unemployment estimate announced by the Department of Energy during the 1977-78 coal strike are addressed. Recommendations to the Secretary of Energy and the Chairman of the Federal Energy Regulatory Commission are pointed out. M.M.M.

N79-30730# European Space Agency, Paris (France).
PHOTOVOLTAIC GENERATORS IN SPACE
K. Bogus, ed and T. D. Guyenne, ed Nov. 1978 344 p refs Proc. of 1st European Symp. on Photovoltaic Generators in Space, Noordwijk, Neth., 11-13 Sep. 1978
(SP-140) Avail: NTIS HC A15/MF A01

A series of lectures was given including, as main topics, solar cell technology, module and blanket technology, design analysis and verification, interface problems, evolution of photovoltaics, solar power satellites, solar arrays, and test results as well as flight data. For individual titles, see N79-30731 through N79-30766.

N79-30731# Plessey Co. Ltd., Towcester (England). Allan Clark Research Center.
HETEROSTRUCTURE GaAs SOLAR CELLS
J. W. Burgess, R. Davis, B. T. Debney, and J. R. Knight *In* ESA Photovoltaic Generators in Space Nov. 1978 p 3-6 refs (For primary document see N79-30730 21-44)
Avail: NTIS HC A15/MF A01

The design of GaAs solar cells for space usage is consid-

ered. Heteroface multilayer structures in Ga Al As/GaAs are compared with structures in which the aluminum content is linearly graded through the thickness. Design principles for cells applicable to a space environment are contrasted with those suitable for terrestrial applications. The effects of radiation damage are included in the modeling and designs are optimized for maximum radiation hardness. Author (ESA)

N79-30732# AEG-Telefunken, Wedel (West Germany).
SPACE APPLICATION OF LARGE AREA TERRESTRIAL SOLAR CELLS FOR MULTI-KW-ARRAYS
H. Bebermier *In* ESA Photovoltaic Generators in Space Nov. 1978 p 7-14 refs (For primary document see N79-30730 21-44)
Avail: NTIS HC A15/MF A01

Future development activities in the field of space silicon solar arrays were studied, considering the applicability of low cost photovoltaic solar arrays for terrestrial use. Investigations indicate that large area solar cells represent an optimum solution due to technology and cost reductions for large area solar arrays of the post Spacelab mission. Author (ESA)

N79-30733# AEG-Telefunken, Heilbronn (West Germany). Semiconductor Div.
ANALYSIS OF THIN SILICON SOLAR CELL STRUCTURES
K.-D. Rasch and K. Roy *In* ESA Photovoltaic Generators in Space Nov. 1978 p 15-18 refs Sponsored by Bundesmin. fuer Forsch. u. Technol. (For primary document see N79-30730 21-44)
Avail: NTIS HC A15/MF A01

Photovoltaic and thermal properties of high efficiency thin silicon solar cells were analyzed. An advanced cell with a back surface reflector is described. Resulting from detailed analysis, design rules for thin and very thin cells are derived to optimize the performance at operating conditions. Author (ESA)

N79-30734# Katholieke Universiteit te Leuven (Belgium). ESAT Lab.
RECENT DEVELOPMENT IN MIS AND INDUCED JUNCTION SILICON SOLAR CELLS
R. vanOverstraaten, R. Mertens, and P. vanHalen *In* ESA Photovoltaic Generators in Space Nov. 1978 p 19-22 refs (For primary document see N79-30730 21-44)
Avail: NTIS HC A15/MF A01

The development and evolution of silicon metal-isolator-semiconductor (MIS) solar cells is presented. The features of the cell, which could be attractive for possible use in space, are outlined. Grating MIS cells could show an enhanced efficiency due to their high UV spectral response, their low temperature fabrication process, and their grating structure which in an ideal case yields higher open circuit voltages. The degradation of these cells show that they may be more susceptible to radiation than conventional diffused cells. Author (ESA)

N79-30735# Barcelona Univ. (Spain). Escuela Tec. Sup. de Ingen. de Telecommun.
ANALYSIS OF THE ACCURACY OF THE ELECTRICAL CHARACTERIZATION METHODS OF LARGE AREA SILICON SOLAR CELLS
L. Castener and J. Cabestany *In* ESA Photovoltaic Generators in Space Nov. 1978 p 23-30 refs Sponsored in part by Comm. Asesora para la Invest. Cient. y Tec. (For primary document see N79-30730 21-44)
Avail: NTIS HC A15/MF A01

The limitations of the electrical characterization methods for dealing with large surface solar cells and low-quality materials cells is described. The application of numerical methods to equivalent circuit parameters determination with a four parameter model that considers separately the current contribution of diffusion, the surface, and recombination processes is also described. The validity conditions of the open circuit voltage transient and recovery time transient experience are pointed out and several practical results are given. Author (ESA)

N79-30736# AEG-Telefunken, Wedel (West Germany).
SOME CURRENT DEVELOPMENTS IN SOLAR ARRAY TECHNOLOGY AT AEG-TELEFUNKEN
J. Koch *In* ESA Photovoltaic Generators in Space Nov. 1978 p 33-40 refs Sponsored by Bundesmin. fuer Forsch. u. Technol. (For primary document see N79-30730 21-44)
Avail: NTIS HC A15/MF A01

Techniques applicable to solar generators with advanced requirements were developed, including repair technique for welded solar cells on a single cell basis, the space qualification of a new low outgassing silicon adhesive for solar cell bonding, and a solar cell interconnector design with extended fatigue lifetime, made by etching on silver foil. Author (ESA)

N79-30737# AEG-Telefunken, Wedel (West Germany).
NEW FLEXIBLE SUBSTRATES WITH ANTI-CHARGING LAYERS FOR ADVANCED LIGHTWEIGHT SOLAR ARRAYS
D. Ruesch *In* ESA Photovoltaic Generators in Space Nov. 1978 p 41-48 refs Sponsored by Bundesmin. fuer Forsch. u. Technol. (For primary document see N79-30730 21-44)
Avail: NTIS HC A15/MF A01

Increasing power demands for future space missions has stimulated the development of large-area flexible solar arrays. Several flexible substrates for application to large area flexible solar arrays according to mission requirements were developed. Various methods for providing a rear-side anti-charging layer were also developed. The mechanical and physical properties of glass fiber, carbon fiber, and aramid fiber, reinforced Kapton substrates are presented. Fabrication processes are described. Recommendations are given for suitable applications of the various substrate types in space solar arrays. Author (ESA)

N79-30738# International Research and Development Co. Ltd., Newcastle (England).
THE FATIGUE PROPERTIES OF SOLAR CELL INTERCONNECTORS
R. B. Evans and S. Stevens *In* ESA Photovoltaic Generators in Space Nov. 1978 p 49-55 refs Sponsored by ESTEC (For primary document see N79-30730 21-44)
Avail: NTIS HC A15/MF A01

The fatigue properties of varieties of silver plated molybdenum and silver mesh solar cell interconnectors were determined by deflection controlled cyclic tests at low temperature using a specially designed test unit. While the test conditions did not exactly simulate those experienced in service, the results allow comparisons to be made based on the fatigue properties of existing interconnectors and conclusions to be drawn as to the effect of interconnector characteristics on fatigue resistance. Author (ESA)

N79-30739# European Space Agency, Noordwikj (Netherlands).
ACCELERATED THERMAL CYCLING OF SOLAR ARRAYS SAMPLES
J.-C. Larue and H. U. Amberg (Karl Weiss-Giessen KG) *In* ESA Photovoltaic Generators in Space Nov. 1978 p 57-62 refs (For primary document see N79-30730 21-44)
Avail: NTIS HC A15/MF A01

The accelerated thermal cycling facility at ESTEC is designed for testing of lightweight solar cell modules with an acceleration factor of 50 compared to low earth orbit conditions. A description of the principle and all technical aspects and critical areas are presented. These include thermal exchangers, fan-blowers, automation and programs, temperature control, temperature induced pressure variations, leakage and freezing, thermal stresses on moving parts, and liquid nitrogen consumption. The performance and the economics of the test method are compared to other conventional methods. A practical case of sample testing is described in some detail as an example of operational use together with sample inspection methods and failure mode analysis (visual inspection, X-rays, electrical performance testing). Author (ESA)

N79-30740# Aerospace Engineering Office, Zurich (Switzerland).
ANALYSIS AND VERIFICATION ASPECTS OF LARGE FLEXIBLE SOLAR ARRAY DESIGN
K. J. Zimmerman *In* ESA Photovoltaic Generators in Space Nov. 1978 p 65-70 refs (For primary document see N79-30730 21-44)
Avail: NTIS HC A15/MF A01

Mathematical models accounting for the various effects of solar array behavior are discussed. Structural analysis algorithms

applicable to investigate the design layout, the optimum design changes to best meet the requirements as well as the correlation of the mathematical model are presented. The approach of a design verification which accounts for the various implications and enables a sufficiently accurate prediction of the on-orbit behavior is outlined. Author (ESA)

N79-30741# AEG-Telefunken, Wedel (West Germany).
THE ELECTRICAL POWER INTERFACE BETWEEN SOLAR ARRAY AND POWER CONDITIONING
B. Gohrbrandt and B. Goergens *In* ESA Photovoltaic Generators in Space Nov. 1978 p 71-76 refs (For primary document see N79-30730 21-44)
Avail: NTIS HC A15/MF A01

Shunt regulated kW power range solar array hot spot problems and adequate countermeasures in both solar array technology and for output voltage regulation are discussed. The power transfer interface is studied. Design solutions which were examined include the use of shunting diodes, solar cells with integral diodes, arrays with single solar cell strings, and the use of other than shunt techniques for array output voltage regulation. Author (ESA)

N79-30742# European Space Agency, Noordwikj (Netherlands).
SOLAR CELL ARRAYS IN UNSTEADY ELECTRICAL OPERATION
O. H. Gruber *In* ESA Photovoltaic Generators in Space Nov. 1978 p 77-85 refs (For primary document see N79-30730 21-44)
Avail: NTIS HC A15/MF A01

Mathematical models concerning small signal disturbances and large signal disturbances of solar cell strings forming part of solar arrays are discussed. Line theory describes small signal disturbances of steady string operation. Nonlinear cell characteristic effects in the large signal case are analyzed and the periodically switching string model is presented. It is concluded that operation of a solar cell string is subject to signal diffusion phenomena when the string potential is to be shunted in a switched mode. Solar cells near the hot end of the string may experience an amplified voltage swing with respect to the average per cell, becoming dissipators of excess power generated by the cells which are located outside the length of diffusion on the string. Author (ESA)

N79-30743# European Space Agency, Noordwikj (Netherlands).
DYNAMIC INTERACTION BETWEEN SOLAR ARRAYS AND CONTROLLED SPACECRAFT
D. Poelaert *In* ESA Photovoltaic Generators in Space Nov. 1978 p 87-92 refs (For primary document see N79-30730 21-44)
Avail: NTIS HC A15/MF A01

The fundamental parameters describing the interaction between the dynamics of large, flexible solar arrays and the spacecraft attitude control system are given. It is shown that the requirements set by the control engineer on the solar array structural design should be more concerned with the modal gains than they were in the past, where almost exclusively modal frequencies and bandwidth considerations were put forward. The baseline of a method is given for the obtainment of the spacecraft modes from the fixed-base modes of one array. The example of the Communications Technology Satellite is given in conjunction with a comparison of finite elements and analytical methods for the dynamic analysis of the array. Author (ESA)

N79-30744# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany).
DEVELOPMENT STATUS OF THE ZKS-BAPTA
W. E. W. Alsbach *In* ESA Photovoltaic Generators in Space Nov. 1978 p 93-98 (For primary document see N79-30730 21-44)
Avail: NTIS HC A15/MF A01

The development status of a bearing and power transfer assembly is presented. Two models were built and successfully subjected to an extensive series of tests, including, two very specific functional tests: a deployment test with a full size solar generator wing of 14 sq m and an accelerated life test simulating a ten year mission at a geostationary orbit. The tested design is suitable for solar arrays up to 6 kW. At the moment design studies are going on for even higher performance data in the 10 to 12 kW range. Author (ESA)

N79-30745# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Div.
A EUROPEAN LOW-COST SOLUTION FOR SPACELAB POWER AUGMENTATION
D. E. Koelle *In* ESA Photovoltaic Generators in Space Nov. 1978 p 101-105 (For primary document see N79-30730 21-44)
Avail: NTIS HC A15/MF A01

The design approach and the capabilities of the Spacelab Power Augmentation System (SPAS) Power Module are examined in relation to possible improvements of he Spacelab capabilities. A modular shuttle payload support structure is used, consisting of tubular carbon filter composite truss elements, spanning the shuttle cargo bay. One specific application in combination with the ultra light platform (ULP) solar array is described which Can serve as a power augmentation module for European Spacelab flights. In this case a two element SPAS structure should be used in combination with the hybrid or simirigid ULP flatpack array with a panel size of 3.3 x 1.1 m. The pallet structure is designed for installation above the Spacelab access tunnel, thus not demanding additional cargo bay length. Author (ESA)

N79-30746# National Aeronautics and Space Administration, Washington, D. C. Space Power Systems Branch.
THE NASA SPACE POWER TECHNOLOGY PROGRAM
J. P. Mullin *In* ESA Photovoltaic Generators in Space Nov. 1978 p 107-111 (For primary document see N79-30730 21-44)
Avail: NTIS HC A15/MF A01

The objective and planning of the NASA space power research and technology program are reviewed. The areas of research covered include photovoltaic energy conversion, chemical energy conversion and storage, thermal to electric conversion, environmental interactions and power systems management of distribution. Author (ESA)

N79-30747# European Space Agency, Noordwikj (Netherlands).
REVIEW OF EUROPEAN SOLAR ARRAY TECHNOLOGY AND POTENTIAL FUTURE DEVELOPMENTS
K. K. Reinhartz *In* ESA Photovoltaic Generators in Space Nov. 1978 p 113-118 refs (For primary document see N79-30730 21-44)
Avail: NTIS HC A15/MF A01

A review of the European solar array technology status considering both ESA and nationally funded developments is presented. Deployable rigid solar arrays as well as flexible roll-out and fold-out arrays and the major components of solar arrays are included. It is expected that in the future, advanced solar array technologies will be needed for television broadcast satellites, earth resources satellites, and shuttle launched and tended spacecraft. The technology for the first two mission types is believed to either exist or to be under development already. The design, development, and manufacture of solar arrays for future Shuttle missions, which may require from 50 to 250 kW array power will represent a major technical challenge if Europe should decide o develop the necessary technology. Author (ESA)

N79-30748# British Aerospace Dynamics Group, Bristol (England).
A STUDY ON SOLAR ARRAYS FOR PROGRAMMES LEADING FROM THE EXTENSION OF SPACELAB TOWARDS SPACE PLATFORMS
P. R. C. Gillett *In* ESA Photovoltaic Generators in Space Nov. 1978 p 119-129 refs Sponsored by ESA (For primary document see N79-30730 21-44)
Avail: NTIS HC A15/MF A01

A review of a mission scenario cavering the period from 1982 to the end of the century is presented, including some preliminary solar array concepts. These concepts range from the augmentation of Spacelab by 6 kW arrays through Power Module and Space Platform arrays along with Pilot Power Plants, to a brief examination of 10 GW Space Solar Power Stations. The second phase of the study concentrates on concepts for a 50 kW Orbiter mounted array, a 55 kW Power Module array, and two types of 2 50 kW Space Platform arrays; these representing

items of likely interest for European contributions to the near and medium term programs. Finally, an outline strategy for the implementation of these arrays is considered. Author (ESA)

N79-30749*# Boeing Aerospace Co., Seattle, Wash.
SOLAR CELLS FOR SOLAR POWER SATELLITES
H. Oman *In* ESA Photovoltaic Generators in Space Nov. 1978 p 133-138 refs (For primary document see N79-30730 21-44)
(Contract NAS9-15196)
Avail: NTIS HC A15/MF A01

The concept of a solar-cell array for a solar power satellite is developed to permit evaluation of its economic feasibility for generating power for delivery to public utilities on earth. Gallium arsenide solar cells were considered but it could not be assured that the world gallium resources could support constructions of two solar power satellites per year. Therefore, for preliminary design an array blanket made from 5 by 10 cm silicon solar cells, 50 microns thick, and electrostatically bonded between borosilicate glass sheets was adopted. In annealing experiments, a radiated 50 microns thick cell was restored to its initial performance in a 500 C. Solar-cell efficiency effects significantly the solar power satellite mass, which varies from 90,000 metric tons for 20 percent cells to 120,000 metric tons for 12 percent cells. The anticipated cost of delivered power, based on 1977 dollars, varies from 4 cents per kWh with 18 percent cells, to 5 cents per kWh for 12 percent efficient cells. Author (ESA)

N79-30750*# Boeing Aerospace Co., Seattle, Wash.
SOLAR POWER SATELLITES: THE ENGINEERING CHALLENGES
G. R. Woodcock *In* ESA Photovoltaic Generators in Space Nov. 1978 p 139-147 (For primary document see N79-30730 21-44)
(Contract NAS9-15196)
Avail: NTIS HC A15/MF A01

Certain elements of solar power satellite design and system engineering studies are reviewed analyzing solar power satellites as a potential baseload electric power source. The complete system concept concept includes not only the satellites and their ground stations, but also the space transportation for delivery of the satellites, piece by piece, into space, and the factories for their construction in space. Issues related to carrying the solar power satellite concept from the present design study phase through implementation of actual hardware are considered. The first issue category is environmental aspects of the SPS systems. The second category of issues is the technology risks associated with achieving the necessary component and subsystem performances. The third category includes the engineering issues associated with carrying out such a large scale project. The fourth issue category is financial: the funding required to bring such a project into being and the costs of the satellites and resulting cost of the power produced as compared to potential alternative energy sources. Author (ESA)

N79-30751# European Space Agency, Noordwikj (Netherlands).
INTERFACE PROBLEMS ON AN SPS SOLAR ARRAY BLANKET
D. Kassing *In* ESA Photovoltaic Generators in Space Nov. 1978 p 149-159 refs (For primary document see N79-30730 21-44)
Avail: NTIS HC A15/MF A01

Starting from a survey of proposed photovoltaic Solar Power Satellite (SPS) configurations, the design trend of solar arrays applicable in an SPS development program is sketched out indicating physical and other interface problems of the solar array sub-system with adjacent sub-system and the space environment. The nature of research and development program on SPS solar cell blankets is descussed and a list containing potential study tasks for the near future is presented. The objective is to identify, from a systems engineering of view, the limiting conditions and interface problems associated with the development and operation of large solar generator blankets to be used in SPS systems and to discuss the nature of the supporting research and technology program aimed at solving the mentioned interface problems. Author (ESA)

N79-30752# Technische Univ., Berlin (West Germany). Inst. fuer Luft und Raumfahrt.
MOSGEN: A POTENTIAL EUROPEAN CONTRIBUTION IN DEVELOPING LARGE SOLAR GENERATORS SUITABLE FOR GROWING POWER LEVELS UP TO SPS-SYSTEMS
J. Ruth and W. Westphal *In* ESA Photovoltaic Generators in Space Nov. 1978 p 161-166 refs (For primary document see N79-30730 21-44)
Avail: NTIS HC A15/MF A01

A potential development program for large solar generators in space, which seems to be suited especially for European needs is discussed. The cost of production and transport have to be reduced to a minimum by constructive and technological steps so that they become competitive power plants. The concept or a modular collector system represents one steps in that direction. The modular philosophy is easily transferable to different sizes and applications of solar generators leading to solar power satellites. An evolutionary strategy of development helps to provide high economical benefit of the modular attempt compared to nonmodular separately developed alternatives. This strategy means governing the development process by feed back dynamic optimization. Author (ESA)

N79-30753# Societe Nationale Industrielle Aerospatiale, Cannes (France).
DEVELOPMENT OF A RIGID FOLD-OUT SOLAR ARRAY FOR THREE AXES STABILIZED GEOSYNCHRONOUS SATELLITES
G. Barkats *In* ESA Photovoltaic Generators in Space Nov. 1978 p 169-180 refs (For primary document see N79-30730 21-44)
Avail: NTIS HC A15/MF A01

For future point-to-point communication spacecraft purposes a rigid fold-out solar array was developed. The electrical and mechanical performances of the development model are described. End of life solar array performance of approximately 25 W/kg is obtained using currently mass produced solar cells. The qualification test program and the test results are presented. Author (ESA)

N79-30754# Spar Aerospace Products Ltd., Toronto (Ontario).
CANADIAN DEVELOPMENT OF LARGE DEPLOYABLE SOLAR ARRAYS FOR COMMUNICATIONS SPACECRAFT
E. Quittner, H. Borduas, J. T. Renshall, and S. Ahmed (Dept. of Comm., Canada) *In* ESA Photovoltaic Generators in Space Nov. 1978 p 181-192 refs Sponsored by Canadian Dept. of Comm. (For primary document see N79-30730 21-44)
Avail: NTIS HC A15/MF A01

Solar array designs that have the potential of cost-effectively satisfying three-axis stabilized geostationary communications satellite power requirements at beginning of life are discussed. The BI-STEM and Astromast deployed 5 and 10 kW beginning of life array designs are examined. To a varying degree the designs were derived from the flight proven Hermes (CTS) array. Except for the Hermes array, all the array designs have the hybrid capability of re-using the spin-phase array segment cells during on-station operation. These arrays were configured to be used on typical spacecraft compatible with both the Ariane and Space Shuttle launchers. Author (ESA)

N79-30755# British Aerospace Dynamics Group, Bristol (England). Space Div.
OTS SOLAR ARRAY
K. Schneider *In* ESA Photovoltaic Generators in Space Nov. 1978 p 193-200 refs (For primary document see N79-30730 21-44)
Avail: NTIS HC A15/MF A01

The solar array used on the Orbital Test Satellite (OTS) built under ESA contract is discussed. Design essentials and testing of the array are presented. The OTS was launched successfully in May 1978. Transfer orbit and on-station performance and function of the array are in accordance with the predictions. Author (ESA)

N79-30756# British Aerospace Dynamics Group, Bristol (England).
THE ESA SOLAR ARRAY FOR SPACE TELESCOPE
M. Newns, C. J. H. Williams, and R. L. Crabb (ESTEC) *In* ESA

Photovoltaic Generators in Space Nov. 1978 p 201-208 refs (For primary document see N79-30730 21-44)
Avail: NTIS HC A15/MF A01

The 4kW solar array under development in Europe for the shuttle launched, NASA space telescope is described. The array is designed to meet the requirements of astronaut in-orbit maintenance and contingency operation; the particularly demanding requirement to function mechanically and electrically after 5 years in low earth orbit, having encountered some 30,000 thermal cycles; the requirement to satisfy the stringent constraints on array dynamics imposed by an astronomical observatory telescope with a pointing stability of thousandths of an arc second; and the need to be retractable, following a period of service in orbit, for return to earth in the shuttle orbiter bay.
Author (ESA)

N79-30757# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
INTELSAT 5 SOLAR ARRAY
H. Brodersen and I. Rizos *In* ESA Photovoltaic Generators in Space Nov. 1978 p 209-217 refs (For primary document see N79-30730 21-44)
Avail: NTIS HC A15/MF A01

The INTELSAT 5 solar arrays are described. The solar array provides the primary energy source for the first three-axes-stabilized INTELSAT spacecraft, which is designed to satisfy INTELSAT communication requirements for the Atlantic, Pacific and Indian Ocean regions. The solar array is designed to provide approximately 1.2 kW continously at synchronous orbit for a seven year orbital lifetime. The electrical and a mechanical design of the INTELSAT 5 solar array is discussed. The results of specific development tests performed are presented. Also included are the results of the cover integrated cell tests performed on selected solar cell samples.
Author (ESA)

N79-30758# Technische Universitaet, Brunswick (West Germany).
PHOTOVOLTAIC GENERATORS IN SPACE WITH CONCENTRATING REFLECTORS
D. Rex and W. D. Ebeling *In* ESA Photovoltaic Generators in Space Nov. 1978 p 221-119 refs (For primary document see N79-30730 21-44)
Avail: NTIS HC A15/MF A01

Three different types of solar panels with concentration of the sunlight by reflectors are investigated. There are the large linear trough, the small linear trough, and a system with cylinder-parabolic reflectors (SARA). In the latter two systems the reflectors, which are made from thin CFRP or aluminum, are also utilized as radiator fins to cool the solar cells. This cooling proves effective in reducing the solar cell temperatures in spite of the strong sunlight intensity. Thus it is possible to considerably reduce amount of solar cell material needed to produce a certain power and also to reduce the mass to power ratio. A thorough thermal and optical calculation, and optimization, shows that SARA promises the best results, but also the small linear trough should be further investigated. Author (ESA)

N79-30759# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Div.
DEVELOPMENT AND TESTING OF THE ULP SOLAR ARRAY
K. Schneider *In* ESA Photovoltaic Generators in space Nov. 1978 p 231-242 refs (For primary document see N79-30730 21-44)
Avail: NTIS HC A15/MF A01

The ultra lightweight panel (ULP) hybrid flatpack advanced solar array is described. ULP is designed for 3-axis stabilized spacecraft with sun oriented solar arrays and a power requirement of 1 to 10 kW. Its modular concept allows easy adaption to each specified power need. The array consists of anumber of identical panels each having a size of 1 x 3 sq m and consisting of a rigid carbon fiber frame with a pretensioned solar cell blanket. The array was successfully tested under vibration and acoustic noise environmental and was deployed completely in vacuum. It also underwent radiation tests, and conditions and low temperature tests, thus confirming its qualification for space applicability.
Author (ESA)

N79-30760# ISRO Satellite Centre, Peenya, Bangalore (India). Space Dept.
PLANE MIRROR CONCENTRATORS FOR GEOSYNCHRONOUS SATELLITES
S. P. Rosta, P. S. Goel, and A. V. Pakli *In* ESA Photovoltaic Generators in Space Nov. 1978 p 243-245 refs (For primary document see N79-30730 21-44)
Avail: NTIS HC A15/MF A01

An idea to use the combination of a solar cell array and a plane plastic metallized film mirror to reduce the size of sun tracking solar cell arrays on geosynchronous spacecraft is proposed. This concept has significant impact on overall cost and weight reduction for some conventional geosynchronous application spacecraft including Intelsat-5 and Aerosat satellites.
Author (ESA)

N79-30761# British Aerospace Dynamics Group, Bristol (England).
THE ESA LIGHTWEIGHT HYBRID SOLAR ARRAY
P. A. Champion, R. O. Ewen, and E. Suppa (ESTEC) *In* ESA Photovoltaic Generators in Space Nov. 1978 p 247-253 refs (For primary document see N79-30730 21-44)
Avail: NTIS HC A15/MF A01

The ESA lightweight hybrid solar array, now under design and development, aimed initially at high power versions of the heavy platform (typically 6 kw EOL), is discussed. It consists of rigid panels providing power in either spinning or 3-axis stabilized transfer orbit, which also supplement the main stationary orbit power provided by flexible fold-out solar blankets. A key element is the secondary deployment mechanism consisting of a multi-section telescopic mast powered by stored gas. The flexible blanket hold-down and release mechanism is also of novel and ultra-lightweight design. The design and objectives of the program are described and the current development status is reviewed. Potential future developments and applications of the technology embodied are examined.
Author (ESA)

N79-30762# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Raumsimulation.
SIMULATED GEOMAGNETIC SUBSTORM CHARGING CONDITIONS FOR TESTING PHOTOVOLTAIC GENERATORS AND OTHER SATELLITE SURFACE MATERIALS
G. P. Goerler and F. G. Klein *In* ESA Photovoltaic Generators in Space Nov. 1978 p 257-264 refs (For primary document see N79-30730 21-44)
Avail: NTIS HC A15/MF A01

The environmental conditions of a satellite exposed to high energy irradiation on geostationary orbits were reproduced in a space simulation chamber. A description of the experimental arrangement for electron irradiation and the resulting spatial and energetic distribution are presented. The quantities measured during electron irradiation of a test object as leakage current, surface potential, discharge rate, and the discharge current pulse shape analysis are illustrated. Some representative results on irradiated test samples with insulating and conductive surface structure are demonstrated.
Author (ESA)

N79-30763# Royal Air Force, Farnborough (England).
PROTON DAMAGE RATIOS FOR SOME MODERN TYPES OF SOLAR CELLS
M. W. Walkden *In* ESA Photovoltaic Generators in Space Nov. 1978 p 265-272 (For primary document see N79-30730 21-44)
Avail: NTIS HC A15/MF A01

The ratios relating the damage caused by 1 MeV electrons to that caused by protons of various energies are currently being determined for four types of modern solar cells. These include nonreflecting and violet cells of normal thickness, and a 50 microns thick cell. Performance measurements are made at room and at elevated temperatures. Sequential 1 MeV electron irradiation and proton irradiation in the range 2 to 10 MeV has so far been completed. The experimental details, a summary of the results obtained to date, including proton damage ratios at room and elevated temperatures, are presented.
Author (ESA)

N79-30764# European Space Agency, Noordwikj (Netherlands).
QUALIFICATION OF EUROPEAN NONREFLECTIVE SOLAR CELLS

J. C. Larue *In* ESA Photovoltaic Generators in Space Nov. 1978 p 273-278 refs (For primary document see N79-30730 21-44)
Avail: NTIS HC A15/MF A01

Space environment and endurance tests were performed on 55 2 x 4 cm nonreflective (black) silicon solar cells. The qualification program followed the ESA standard specification for space solar cells. All tests were passed successfully. The average beginning of life maximum power of this type of solar cell reached 130 mW at 25 C while after irradiation with 10 to the 15th power e/sq cm at 1 MeV, this power was reduced to 109 mW. These results compare well with previously reported American data for cells of similar technology and represent an improvement over high-efficiency (violet) solar cells qualified two years ago. This advantage is however, offset by a higher operating temperature resulting from an unfavorable alpha/epsilon ratio. Author (ESA)

N79-30765# European Space Agency, Noordwikj (Netherlands).
PREDICTED AS WELL AS IN-ORBIT PERFORMANCES OF ESA-SPONSORED SOLAR ARRAYS DURING THE LATE 70'S
E. Suppa, A. Atzei, R. L. Crabb, and J. Larue *In* ESA Photovoltaic Generators in Space Nov. 1978 p 279-285 refs (For primary document see N79-30730 21-44)
Avail: NTIS HC A15/MF A01

After a short description of the ESA array design along with spacecraft orbital and mission characteristics, the array output predictions and the actual in-orbit performance of various spacecraft are compared. Several questions relevant to future projects are analyzed and conclusions are drawn. In particular four aspects are extensively treated. These are the adequacy of the margin in the power requirements and in the design with reference to the beginning of life performances, the accuracy of the test methods and of the reference standards during pre-flight testing, the requirements on the format and error in telemetry data, and solar array output degradation with verification of design data and a forecast of expected performance. Author (ESA)

N79-30766# Centre National d'Etudes Spatiales, Toulouse (France).
BEHAVIOR OF SOLAR GENERATORS IN LOW ORBITS [COMPORTEMENT DE GENERATEURS SOLAIRES EN ORBITE BASSE]
E. duTrieu *In* ESA Photovoltaic Generators in Space Nov. 1978 p 287-292 In FRENCH (For primary document see N79-30730 21-44)
Avail: NTIS HC A15/MF A01

The performance of the identical generators carried by the D2B cnd the Signe 3 satellites was analyzed and compared. The current supplied (1 sub GS) was very close in both cases although the orbits of the satellites have been very different. After 200 days of orbital life, the 1 sub GS degraded about 8%. The law of variation is logarithmic with time. As regards temperature, there is good agreement between theory and the results telemetered from Signe 3. No evidence can be given for the development of the thermo-optical characteristics of the generators. Transl. by A.R.H.

N79-30767# Illinois Univ. at Urbana-Champaign, Urbana. Coordinated Science Lab.
A SINGULAR PERTURBATION APPROACH TO POWER SYSTEM DYNAMICS Ph.D. Thesis
John Jay Allemong Aug. 1978 223 p refs
(Contract DAAB07-72-C-0259; Grant NSF ENG-75-14100)
(AD-A069859; R-818; UILU-ENG-78-2211) Avail: NTIS HC A10/MF A01 CSCL 09/3

This report applies singular perturbation techniques to linear and non-linear models of a single machine-infinite bus power system and a three machine power system. In the linear realm, we give a method for obtaining state and eigenvalue approximations by computing approximations to the block diagonal system which isolates the fast and slow dynamics. We also give a 'growth of model' method for determining the slow and fast variables in the power system models. For the non-linear systems, we find that the zero-order approximation of the slow variables is inadequate because it does not account for a non-negligible fast component which is present in these variables. Thus we develop a new and simple method to correct the non-linear zero-order approximations. GRA

N79-30768# EIC, Inc., Newton, Mass.
BASIC STUDIES OF THE LITHIUM SECONDARY ELECTRODE Technical Report, 1 Feb. 1978 - 31 Jan. 1979
S. Barry Brummer, Victor R. Koch, Jay L. Goldman, Richard M. Mank, and Cynthia J. Mattos Apr. 1979 27 p refs
(Contract N00014-77-C-0155)
(AD-A069846; C-480; TR-2) Avail: NTIS HC A03/MF A01 CSCL 10/3

Rechargeable high energy density Li batteries require an efficient Li electrode. Earlier work with propylene carbonate (PC), methyl acetate (MA), and tetrahydrofuran (THF)-based electrolytes yielded poor Li electrode cycling efficiencies due to the electrolyte reduction by Li. We find 2-methyltetrahydrofuran (2-Me-THF)/LiAsF6 media to be remarkably stable toward Li resulting in cycling efficiencies which approach 98%. The ability of 2-Me-THF in particular, and alpha-methylated THFs in general, to resist reduction by Li is thought to be based on the position of its lowest unfilled molecular orbital (LUMO) relative to that of THF. Author (GRA)

N79-30769# EIC, Inc., Newton, Mass.
INVESTIGATIONS OF THE SAFETY OF Li/SOCl2 BATTERIES Quarterly Report, 30 Sep. - 30 Dec. 1978
Kuzhikalail M. Abraham, Richard M. Mank, and Gerhard L. Holleck May 1979 52 p refs
(Contract DAAB07-78-C-0564; DA Proj. 1L1-62705-AH-94)
(AD-A069797; C-536; DELET-TR-78-0564-1; QR-1) Avail: NTIS HC A04/MF A01 CSCL 10/3

Forced overdischarge behavior of Li/SOCl2 cells was studied using spirally wound C-size and small prismatic cells. Cathode and anode limited cells were tested. Cathode limited cells could be overdischarged for long periods of time without explosions. Anode limited cells are potentially hazardous. One out of three cells overdischarged at 100 mA exploded. Author (GRA)

N79-30770# Johns-Manville Sales Corp., Denver, Colo. Research and Development Center.
PERFORMANCE AND EVALUATION OF CONCEPTS AND DEVICES FOR HEAT RECLAMATION FROM AIR CONDITIONERS, HEAT PUMPS, AND REFRIGERATION EQUIPMENT Final Report
S. S. Mohammadi (Colorado School of Mines) and E. D. Sloan (Colorado School of Mines) Aug. 1978 43 p refs
(Contract DAAK70-78-D-0002)
(AD-A069650; USAFESA-TSD-2057) Avail: NTIS HC A03/MF A01 CSCL 13/1

A heat recovery system is described which uses air conditioner or heat pump waste heat for domestic water heating. Current commercial units and field test data are detailed with economic guidelines to aid in choice of a unit. This report enables the reader to determine the cost effectiveness of having such a unit installed. Safety, product warranty, and city and state coding restrictions are discussed. The current and future testing and demonstration plans are cited for the unit. GRA

N79-30771# Market Facts, Inc., Washington, D. C.
SMALL WIND ENERGY: FOCUS GROUP RESULTS
1978 43 p
(Contract EV-78-C-01-6458)
(DOE/TIC-10018) Avail: NTIS HC A03/MF A01

The potential for commercialization of small wind energy was evaluated. The barriers to development of this resource were determined. Actions required by the Federal Government to promote commercialization were also determined. DOE

N79-30772# Sandia Labs., Albuquerque, N. Mex.
SOME VARIABILITY STATISTICS OF AVAILABLE WIND POWER
J. W. Reed Mar. 1979 50 p refs
(Contract EY-76-C-04-0789)
(SAND-78-1735) Avail: NTIS HC A03/MF A01

The long-term variability of available wind power was studied in ten-year records of hourly wind speed observations at fifteen selected weather stations. Month by month and year by year

sums of wind power occurrences were used to generate average, standard deviation, and autocorrelation statistics. The amplitude of the annual cycle in available wind power was at least 70% of the average at all locations. Long term integrated power production showed maxima and minima that differed by 36 to 91% from average annual production. DOE

N79-30773# Sandia Labs., Albuquerque, N. Mex.
ECONOMIC OVERVIEW OF VERTICAL AXIS WIND TURBINES
W. N. Sullivan 1979 9 p Presented at the EPRI Wind-Energy Econ. Workshop, Monterey, Calif., 27 Mar. 1979
(Contract EY-76-C-04-0789)
(SAND-79-9733C; Conf-790352-1) Avail: NTIS HC A02/MF A01

The class of vertical axis wind turbines (VAWT) investigated use curved, fixed-pitch blades of constant section rigidly attached to a vertical rotating tower. Qualitatively, the main advantages of the VAWT over more conventional, propeller-type machines are the elimination of yaw controls, the placement of mechanical equipment at ground level, its amenability to simple, low-cost blade fabrication techniques, and aerodynamic stall characteristics which eliminate the need for active pitch control devices. The main disadvantages relative to modern propeller machines are a somewhat lower aerodynamic efficiency (about 10 percent lower), the limited ability of the rotor to self-start, and generally lower rotor operating RPM's, which leads to higher torque capacity requirements for the drive train. DOE

N79-30774# TRW, Inc., McLean, Va. Energy Systems Planning Div.
COST AND PERFORMANCE EVALUATION OF PASSIVE SOLAR SYSTEMS
Nov. 1978 68 p refs
(Contract W-31-109-eng-38)
(ANL/EES-TM-34) Avail: NTIS HC A04/MF A01

This study was undertaken to produce a detailed methodology for designing optimal passive solar systems for single family residences. Earlier work showed that passive solar systems were economically more favorable than conventional HVAC systems. The earlier results were refined and a broader range of passive solar system configurations were examined in a wider variety of climate and insolation conditions. This study was divided into the following four major tasks: methodology development, refinement of cost and performance data, development of computer program, and analysis of thermal/storage walls. DOE

N79-30775# BDM Corp., Albuquerque, N. Mex.
PHOTOVOLTAIC TRANSIENT ANALYSIS PROGRAM: USER'S GUIDE. VOLUME 4: SUPPORTING DATA
T. J. Lambarski, A. F. Malmberg, K. E. Melick, R. M. Turfler, and M. G. Semmens Oct. 1978 155 p
(Contract EY-76-C-04-0789)
(SAND-78-7038-Vol-4) Avail: NTIS HC A08/MF A01

Some of the runs used to validate the PV cell and PV aggregate models are presented. The data and parameters for the runs were obtained from I-V curves taken on 3 inch diameter silicon flat plate solar cells and panels constructed from these same cells. The measured I-V curves were included for comparison. Illuminated curves are standard half sun and one sun curves. Dark forward curves are plotted in similar coordinates with positive currents rather than negative current as is expected from PV cell current conventions. Empirical data on solar cells, solar cell packaging and peripheral devices are summarized. The information is grouped according to solar cells electrical characteristics, packaging dependent electrical characteristics, peripheral interconnections characteristics, and into concentrator cells and polycrystalline silicon characteristics. DOE

N79-30776# Brookhaven National Lab., Upton, N. Y.
ROLE OF THE VAPOR COMPRESSION CYCLE IN SOLAR ENERGY UTILIZATION
Edward A. Kush, Jr. 1978 5 p refs Presented at Meeting of the Am. Section of the Intern. Solar Energy Soc., Denver, 28 Aug. 1978
(Contract EY-76-C-02-0016)
(BNL-24573; Conf-780808-14) Avail: NTIS HC A02/MF A01

The vapor compression cycle lends itself to solar energy utilization in two important ways. Its ability to utilize a relatively low temperature heat supply to produce space heating via heat pumps allows the use of solar input to the evaporator to provide potential coefficients of performance which are 2 to 3 times higher than present electric driven heat pumps, and the use of relatively inexpensive solar collectors is possible since the collection temperatures can be low grade. Secondly, the compression process of the vapor cycle can be powered by a solar-driven heat engine, typically using a Rankine cycle, for solar cooling purposes. Discriminating coupling of solar with vapor compression allows the well-developed technology and manufacturing capability of the vapor compression industry to be brought into play in the solar field, widening its base and promoting its diversification. The cycle thermodynamics, potential practical hardware, and R and D projects in both of these areas are reviewed. Particular attention is given to the solar assisted heat pump and its characteristics and the heat pump simulator activities at Brookhaven National Laboratory. DOE

N79-30777# Wayne State Univ., Detroit, Mich.
CUPROUS OXIDE PHOTOVOLTAIC CELLS
Dan Trivich, E. Y. Wang, R. J. Komp, and A. S. Kakar 1978 5 p refs Presented at the IEEE Photovoltaic Specialists Conf., Washington, D. C., 5 Jun. 1978
(Contract ET-78-S-02-4726)
(CONF-780619-16) Avail: NTIS HC A02/MF A01

Cuprous oxide, with a band gap of 2.0 eV, is an attractive material for solar cells because of low cost and great availability. The current conversion efficiency is 1 percent, but theoretical estimates are greater than 13 percent. For various Schottky barriers, e.g., Al/Cu2O, it is proposed that the V/sub oc/ is limited by chemical conversion of the junctions to Cu/Cu2O junctions, and the model is supported by Auger and ESCA results. It is proposed to avoid the reaction by use of an oxide interlayer as in Al/Al2O3/Cu2O, which also gives an MIS structure, but only minimal success has yet been achieved with the methods tried. Sb2O3 and SiO/sub x/ layers were explored. Another approach could be to use oxide heterojunctions on Cu2O. Several were explored and ZnO/Cu2O was best. In and Cd are effective dopants for Cu2O. With samples annealed at 500 C, diffusion lengths of approximately 4 micron were measured by an SPV method. The spectral sensitivity of Cu/Cu2O cells has a threshold at 630 nm and a maximum at 500 nm. DOE

N79-30778# California Univ., Berkeley. Lawrence Berkeley Lab.
STRUCTURE OF A BLACK CHROME SOLAR SELECTIVE SURFACE
Carl M. Lampert Jul. 1978 6 p refs Presented at the Meeting of the Am. Section of the Intern. Solar Energy Soc., Denver, Colo., 28 Aug. 1978
(Contract W-7405-eng-48)
(LBL-6691-Rev; Conf-780808-11) Avail: NTIS HC A02/MF A01

The structure of Chrom-Onyx type of black chrome/metal selective absorber was studied to gain a better understanding of its influence upon the mechanisms of wavelength selectivity. Spectral reflectance measurements were performed on seven samples. The best selectivity was found by these measurements to be 0.7 micron of black chrome on nickel and 1.0 micron of black chrome on copper. Both scanning and transmission electron microscopy were employed to study microstructure and chemical composition. As a result of the combined studies, some effects of black chrome thickness and the metallic substrate were determined. It was found that black chrome consisted of a very fine metallic distribution of particles of chromium, possibly suspended within a matrix of an oxide of chromium. This combination was, in turn, agglomerated into larger particles within 0.05 to 0.3 micron size range. These larger particles formed a network which constituted the surface coating. DOE

N79-30779# California Univ., Berkeley. Lawrence Berkeley Lab.
ENERGY UTILIZATION ANALYSIS OF BUILDINGS
M. Lokmanhekim Jun. 1978 20 p refs Presented at the Symp. on Solar Energy, Cairo, 16 Jun. 1978
(Contract W-7405-eng-48)

(LBL-7826; Conf-780667-4) Avail: NTIS HC A02/MF A01

The accurate calculation of the energy requirements and heating and cooling equipment sizes for buildings is one of the most important, as well as one of the most difficult problems facing the engineer. The fundamental principles utilized in the procedures developed by American Society of Heating, Refrigerating and Air-Conditioning Engineers are explained and brief descriptions of the computer programs using these procedures are given. Such computer programs generally are capable of simulating the thermal response of a building to all sources of heat gains and losses, accounting for all nonthermal energy requirements in the building or on the sites, translating the building operating schedules into energy demand and consumption, identifying the peak capacity requirements of heating and cooling equipment, and performing an economic analysis that would select the most economical overall owning and operating cost. equipment and energy source that minimize the building's life cycle cost. DOE

N79-30780# Sandia Labs., Albuquerque, N. Mex.
STATUS OF THE DOE PHOTOVOLTAIC SYSTEMS ENGINEERING AND ANALYSIS PROJECT
G. J. Jones and D. G. Schueler 1978 6 p refs Presented at the IEEE Photovoltaic Specialists Conf., Washington, D. C., 5 Jun. 1978
(Contract EY-76-C-04-0789)
(SAND-78-0955C; Conf-780619-14) Avail: NTIS HC A02/MF A01

The economic viability of photovoltaic power systems depends not only on the reduction of photovoltaic array prices but also on the realization of acceptable total installed system price. The allowable total installed system price is calculated for various major application sectors, based on a range of projected levelized energy costs. These allowable prices are then compared to projected prices which are obtained by examining the current and future expected prices of the major subsystems comprising an operational system. Based on this comparison an assessment of the status of the major subsystem technologies, exclusive of the photovoltaic array, is given and areas requiring emphasis are identified. DOE

N79-30781# Argonne National Lab., Ill.
RELIABILITY, MAINTAINABILITY, AND MATERIALS PERFORMANCE OF SOLAR DEMONSTRATION SYSTEMS
Prem S. Chopra 1978 9 p Presented at the Conf. on the Energy Solar Updates, Atlanta, 12 Jul. 1978
(Contract W-31-109-eng-38)
(ANL/EES-CP-14; Conf-780701-1) Avail: NTIS HC A02/MF A01

The Department of Energy is conducting the National Program for Solar Heating and Cooling of Buildings. A major element of that program is the National Solar Data Program which includes data collection, evaluation and report publication. Information and technical data are being collected and reported on a number of residential and commercial sites. Recently, a program was initiated at Argonne National Laboratory (ANL) under the auspices of the National Solar Data Program to collect, evaluate, and publish reliability, maintainability, and material performance data from these sites. The plans which have been made and some of the early results which can be expected from the ANL Solar Data Program are described. DOE

N79-30782# Los Alamos Scientific Lab., N. Mex.
COMPARATIVE ECONOMICS OF PASSIVE AND ACTIVE SYSTEMS
J. F. Roach, S. A. Noll, and S. Ben-David 1978 41 p refs Presented at the Intern. Symp. Workshop on Solar Energy, Cairo, 16-22 Jun. 1978
(Contract W-7405-eng-36)
(LA-UR-78-1878; Conf-780667-3) Avail: NTIS HC A03/MF A01

As the interest in solar energy applications for residential space heating grows, it becomes imperative to evaluate the economic performance of alternative designs. One passive design is concentrated on-the thermal mass storage wall. The economic performance of this design is examined and subsequently contrasted with one active design-the air collector/rock storage system. Architectural design criteria, solar performance characteristics, and the incremental solar cost of each design is briefly reviewed. Projections of conventional energy prices are discussed, along with the optimal sizing/feasibility criterion employed in the economic performance analysis. In addition, the effects of two incentive proposals-income tax credits and low interest loans-upon each design are examined. Results are reported on a state-by-state basis for the U.S., with major conclusions summarized for each design. It is generally the case that incentives greatly enhance the economics of both system designs, although the contrast is greater for the passive design. Also, against the less expensive conventional fuels (natural gas and heating oil) the passive design was shown to offer a more cost effective alternative than the active system for most states. DOE

N79-30783# Los Alamos Scientific Lab., N. Mex.
SIMPLE TECHNIQUE OF ESTIMATING THE PERFORMANCE OF PASSIVE SOLAR HEATING SYSTEMS
J. D. Balcomb and R. D. McFarland 1978 6 p refs Presented at the 1978 ISES Conf., Denver, Aug. 1978
(Contract W-7405-eng-36)
(LA-UR-78-1571; Conf-780808-15) Avail: NTIS HC A02/MF A01

A method is presented for estimating the annual solar performance of a building using a passive thermal storage wall of the Trombe wall or water wall type with or without night insulation. Tables of performance parameters are given for 84 cities. The method is accurate to +3% as compared with hour-by-hour computer simulations. DOE

N79-30784# Sandia Labs., Albuquerque, N. Mex.
LINEAR CONCENTRATING SOLAR COLLECTORS: CURRENT TECHNOLOGY AND APPLICATIONS
James A. Leonard Jul. 1978 36 p refs
(Contract EY-76-C-04-0789)
(SAND-78-0949) Avail: NTIS HC A03/MF A01

Linear concentrating collector technology is reviewed. Included are fundamentals of the technology; descriptions of collectors with particular emphasis on the types tested at the DOE/Sandia Midtemperature Solar Systems Test Facility (MSSTF); performance test results; problems identified through operating experience; cost projections; and a discussion of applications of linear concentrating and midtemperature solar collectors. DOE

N79-30785# Department of Energy, Washington, D. C. Div. of Solar Applications Developments.
NATIONAL SOLAR HEATING AND COOLING COMMERCIAL DEMONSTRATION PROGRAM: KEY PERSONNEL DIRECTORY
Jan. 1979 152 p
(DOE/CS-0057) Avail: NTIS HC A08/MF A01

Firms and individuals who are principal participants in The Department of Energy (DOE) solar heating and cooling demonstration projects for Federal and non-Federal commercial buildings are identified. This directory is intended to facilitate communication with and among active participants in demonstrations of solar heating and cooling technology currently sponsored by DOE. The listing provides identification for several participants in each active DOE commercial demonstration project. When available, identifying information is provided for owners, architects, solar designers, mechanical engineers, builders, and other key personnel directly involved in each project. DOE

N79-30786# Battelle Pacific Northwest Labs., Richland, Wash.
ENERGY-INTENSIVE INDUSTRY FOR ALASKA. VOLUME 1: ALASKA COST FACTORS, MARKET FACTORS, SURVEY OF ENERGY-INTENSIVE INDUSTRIES Final Report
W. H. Swift, M. Clement, E. G. Baker, D. C. Elliot, J. J. Jacobsen, T. B. Powers, C. A. Rohrmann, and G. L. Schiefelbein Sep. 1978 267 p refs 3 Vol.
(Contract EY-77-C-06-1002-001)
(TID-29025/1) Avail: NTIS HC A12/MF A01

The Alaskan and product market factors influencing industry locations in the state are described and a survey of the most energy-intensive industries is presented. Battelle analyzed the factors external to Alaska that would influence development and the cost of energy and labor in Alaska. This volume covers the industries likely to be drawn to Alaska because of its energy resources and analyzes these in terms of: (1) cost of using

Alaska energy resources in Alaska as apposed to the Lower 48; (2) skill-adjusted wage and salary differentialls between relevant Alaskan areas and the Lower 48; and (3) basic plant and equipment and other operating-cost differentials between relevant Alaskan areas and the Lower 48. This report also develops an understanding of the likely level at which development might take place and its timing. Industries that will tend to locate in Alaska as a result of energy consideration are listed, in order of merit: lime, aluminum, portland cement, methanol, carbon black, ammonia, and chlorine industries. DOE

N79-30787# Battelle Pacific Northwest Labs., Richland, Wash.
ENERGY INTENSIVE INDUSTRY FOR ALASKA. VOLUME 2: CASE ANALYSIS Final Report
Kent Miller Sep. 1978 107 p refs 3 Vol.
(Contract EY-77-C-06-1002-001)
(TID-29025/2) Avail: NTIS HC A06/MF A01

Volume 1 evaluated a number of energy industries that might be attracted to the state as a consequence of the availability of its large and diversified sources of primary energy. However, it was concluded that of all industries examined, the primary aluminum metal industry (the most energy-intensive) appeared to be the most likely to succeed in Alaska, assuming the future availability of a large block of low-cost hydropower. It was further concluded that, due to the trends in the domestic and worldwide aluminum industry and markets and the potential implications, a large electroprocess industry would have to interphase with Alaska's electric-power-supply planning; so, a more detailed analysis of that industry's potential was warranted. The aluminum industry is examined in detail as a model locational analysis of an industry along with the environmental economic, and electric-power implications. DOE

N79-30788# Battelle Pacific Northwest Labs., Richland, Wash.
ENERGY-INTENSIVE INDUSTRY FOR ALASKA. VOLUME 3: BACKGROUND DATA
Kent Miller Sep. 1978 320 p refs Prepared in cooperation with Alaska Univ., Anchorage 3 Vol.
(Contract EY-77-C-06-1002-001)
(TID-29025/3) Avail: NTIS HC A14/MF A01

Background data are summarized on evaluating energy-intensive industry for Alaska covering objectives, available infrastructure, and possible future economic growth. Catalogs are presented of energy, mineral, and renewable natural resources on which industrial development may be based. DOE

N79-30789# Department of Energy, Washington, D. C.
PHOTOVOLTAICS. COMMERCIALIZATION PHASE 3 PLANNING
Sep. 1978 27 p refs
(DOE/ERD-0008) Avail: NTIS HC A03/MF A01

Environmental, health, and safety concerns associated with commercialization of photovoltaic energy technologies are identified and discussed. The characteristics of the technology is highlighted; status information on the technical and environment R and D programs is provided; a milestone chart is presented representing a relationship between a considered commercialization chart and relevant R and D; and the environmental concerns significant to the technology are reviewed. The likelihood and consequences of adverse findings, the problems and uncertainties stemming from current or anticipated environmental regulation, and potential costs of environmental controls are examined. Outstanding environmental contribution of environmental control costs to total energy costs is presented for current standards and possible new standards. DOE

N79-30790# Argonne National Lab., Ill. Fusion Power Program.
FUSION ENERGY FOR ALTERNATIVE APPLICATIONS: THE GENERATION OF SYNTHETIC GASEOUS FUELS Interim report
Jan. 1979 110 p refs
(Contract W-31-109-eng-38)
(ANL/FPP/TM-117) Avail: NTIS HC A06/MF A01

Methods for generating synthetic fuels from the high temperature process heat produced by fusion reactors is discussed. A high temperature fusion reactor blanket design is presented which has the capability to produce process heat in excess of 1000 C, eliminates ceramics are structural materials in the reactor, and is self sustaining with respect to tritium breeding. A.W.H.

N79-30791# Elrick and Lavidge, Inc., San Francisco, Calif.
GEOTHERMAL/HYDROTHERMAL ENERGY. GROUP INTERVIEW
1 Aug. 1978 14 p
(Contract EV-78-C-01-6457)
(DOE/TIC-10030) Avail: NTIS HC A02/MF A01

A group interview conducted on geothermal/hydrothermal (liquid dominated) energy suitable for generating electricity and/or direct heat applications was analyzed. The group was composed of representatives of the following types of organizations: electric utilities, geothermal developers, industrial process heat users, engineering consultants, equipment manufacturers, environmentalist, regulatory commission, and financial institutions. The analysis was divided into four subjects: commercial feasibility, future market potential, the relative importance of barriers to commercialization, and the proper role of the Federal Government. DOE

N79-30792# Colorado Univ., Boulder. Dept. of Mechanical Engineering.
MODELING HEAT AND MASS TRANSFER AT THE MESA GEOTHERMAL ANOMALY, IMPERIAL VALLEY, CALIFORNIA Final Report
D. R. Kassoy and K. P. Goyal Feb. 1979 175 p refs
(Contract W-7405-eng-48)
(LBL-8784) Avail: NTIS HC A08/MF A01

The geothermal reservoir modeling effort is reviewed and technical accomplishments during the final funding period are described. It is concluded that a physically viable mathematical model of an unexploited geothermal system can be constructed in terms of the fault zone controlled charging of the thermally active section of a reservoir. DOE

N79-30793# Barber-Nichols Engineering Co., Arvada, Colo.
GEOTHERMAL PUMP TEST FACILITY Final Report, Jul. 1977 - Jul. 1978
R. W. Blakemore Sep. 1978 16 p
(Contract EY-76-C-04-3715)
(ALO-3715-1) Avail: NTIS HC A02/MF A01

The design configuration and fabrication of a transportable geothermal pump test facility are described. The test facility, consisting of a test rig and data acquisition system trailer, provides the user with the unique opportunity to develop and calibrate geothermal pumps with less liability and risk, and at lower cost than would be incurred by actually installing the pump in a geothermal well. Pump tests may be performed using either domestic water, heated by pumping energy, or by using actual geothermal brines supplied directly to the test rig which would be located adjacent to the well. The geothermal pump test facility is completely self supporting and requires only an electrical supply source to become fully operational. DOE

N79-30794# Sandia Labs., Livermore, Calif.
PREDICTION OF YEARLY FLUID REPLENISHMENT RATES FOR HYDROCARBON FLUIDS IN THERMAL ENERGY STORAGE SYSTEMS
V. P. Burolla Apr. 1979 56 p refs
(Contract EY-76-C-04-0789)
(SAND-79-8209) Avail: NTIS HC A04/MF A01

Economic analysis of any thermal energy storage system using hydrocarbon fluids at or near their operating limit hinges on accurate determinations of fluid losses due to thermal and environmental effects. Representative values for these fluid losses in an operating thermal storage system for three different hydrocarbon fluids, Sun 21, Caloria HT43, and Therminol 66 are presented. DOE

N79-30795# Oak Ridge National Lab., Tenn.
ECONOMY OF A RETROFIT SOLAR SYSTEM
J. M. Schreyer 1979 20 p ref Presented at the 6th Energy Technol. Conf. and Exposition, Washington, D. C., 26 Feb. 1979
(Contract W-7405-eng-26)
(CONF-790213-2) Avail: NTIS HC A02/MF A01

The The use of 8 flate plate collectors each 10 sq ft for the solar water system retrofitted on a 20 year old house is

presented. A 50/50 glycol/water fluid was circulated through the collector circuit. A 120 gal galvanized water tank was used for storage. An economic analysis of the hot-water system is presented. DOE

N79-30796# Logistics Management Inst., Washington, D. C.
INTERNATIONAL ENERGY EVALUATION SYSTEM. VOLUME 2: TECHNICAL DOCUMENTATION, SEPTEMBER 1, 1978
M. L. Shaw and B. J. Allen Mar. 1979 277 p
(Contract EC-77-C-01-8602)
(HCP/L8602-01/2) Avail: NTIS HC A13/MF A01

A model was developed to analyze the impact of various national and international policies on energy flows between the U.S. and the rest of the world. This model forecasts equilibrium levels and prices for a typical day in 1985 and 1990. The modeling structure and its objectives are described. The demand for energy in the U.S., the other Organization for Economic Cooperation and Development countries, and the non-OECD regions-each of which is analyzed using different modeling approaches are discussed. The supply of primary energy materials, their transportation to consuming regions, and their conversion to final demand products are examined. The mathematical formulation of the problem and how the supply, transportation, conversion, and demand activities are combined to produce an equilibrium is presented. DOE

N79-30797# Logistics Management Inst., Washington, D. C.
ENERGY SECTOR CAPITAL REQUIREMENTS, 1978-1985
Jan. 1979 64 p Sponsored by DOE
(DOE/EIA-0103/24) Avail: NTIS HC A04/MF A01

The approach used, and the values derived, to estimate capital requirements for the energy sector of the U.S. economy for the period 1 Jan. 1978 to 1 Jan. 1985 are described. The capital requirements of the energy supply industries needed to produce the energy equilibrium levels projected to 1985 are discussed. The capital requirements estimates for the major energy subsectors and three supply/demand scenarios are summarized. Energy subsectors addressed include oil and gas production and refining, coal, electric utilities (including nuclear generation), and the advanced technologies (solar, geothermal, wind, and synthetics). DOE

N79-30798# Institute of Gas Technology, Chicago, Ill.
ASSESSMENT OF AIR CATHODES FOR METAL/AIR BATTERIES Final Report, Sep. - Dec. 1978
M. J. Powers, A. F. Sammells, and K. F. Blurton Jan. 1979 50 p refs
(Contract W-7405-eng-48)
(UCRL-13978) Avail: NTIS HC A03/MF A01

The status of air electrodes operating in acid electrolyte was evaluated to determine the performance of such a cell and to identify the major areas where further work is required. The kinetics of oxygen reduction and evolution on a variety of catalysts as a function of temperature, electrolyte, and electrolyte pH were considered. Air electrode polarization curves were calculated, and performance characteristics of the zinc/air acid electrolyte battery was predicted. An electrochemical energy efficiency of 51% was projected at an operating current density of 35 mA/squared cm. This electrode should be stable during the discharge/charge cycles. No major technological barrier limiting the development of acid electrolyte metal/air batteries was seen; however, experimental data are required to confirm estimated cell performances and to determine the stability of the air electrode. DOE

N79-30799# Department of Energy, Washington, D. C. Energy Information Administration.
SHORT-TERM PROJECTIONS OF THE ENERGY SUPPLY AND DEMAND IN THE UNITED STATES FROM THE EIA REPORT TO CONGRESS, 1977 Annual Report
Dec. 1978 108 p
(DOE/EIA-0102/37) Avail: NTIS HC A06/MF A01

Short-term energy projections obtained using the data, industry expertise, and computer-based forecasting models are presented. United States domestic consumption of gross energy inputs (not accounting for generation and transmission losses projected to grow from 73.7 quadrillion BTu (quads) in 1976 to 79.6 quads by 1979, an increase of about 2.6% per year, accelerating somewhat from the 1970-1976 growth rate of about 1.8%. This assumes a mid-range projections of economic activity. A low growth assumption yields a 1979 domestic consumption figure of 79.2 quads (2.4% growth) and the high demand assumption yields consumption of 81.9 quads (3.6% growth rate). The major factors affecting demands and supplies, the ranges of the forecasts, the sensitivity of the forecasts to significant uncertainties, and comparisons with other relevant forecasts are presented. DOE

N79-30800# Department of Energy, Washington, D. C. Office of Consumer Affairs.
ENERGY AND FOOD. OFFICIAL TRANSCRIPT OF PUBLIC BRIEFING AND ADDENDUM, MAY 25, 1978, WASHINGTON, D. C.
Feb. 1979 146 p
(DOE/IR-0041) Avail: NTIS HC A07/MF A01

The briefing was held to respond to questions that consumer and public-interest groups and other members of the public have about the issues of energy and food and the relationships between the two. Fifty-two questions are indexed that were raised relative to this briefing. DOE

N79-30801*# Boeing Engineering and Construction, Seattle, Wash.
APPLICATIONS OF THERMAL ENERGY STORAGE TO PROCESS HEAT STORAGE AND RECOVERY IN THE PAPER AND PULP INDUSTRY Final Report, Sep. 1977 - May 1978
J. H. Carr, P. J. Hurley, and P. J. Martin Sep. 1978 244 p refs Sponsored by NASA
(Contracts EC-77-A-31-1034; EC-77-C-01-5082)
(NASA-CR-159398; CONS-5082-1) Avail: NTIS HC A11/MF A01 CSCL 10C

Applications of Thermal Energy Storage (TES) in a paper and pulp mill power house were studied as one approach to the transfer of steam production from fossil fuel boilers to waste fuel of (hog fuel) boilers. Data from specific mills were analyzed, and various TES concepts evaluated for application in the process steam supply system. Constant pressure and variable pressure steam accumulators were found to be the most attractive storage concepts for this application. DOE

N79-30802# California Univ., Berkeley. Lawrence Berkeley Lab.
ENERGY USE AND CONSERVATION IN INDUSTRIALIZED COUNTRIES
L. Schipper Nov. 1978 46 p refs Presented at the Conf. on Energy Productivity, New York, 2 Nov. 1978
(Contract W-7405-eng-48)
(LBL-7872; Conf-781124-1) Avail: NTIS HC A03/MF A01

Economic factors influencing energy use and development energy saving technology in industrialized countries are discussed. International comparisons of energy use show that there is much technical flexibility and conservation potential within present U.S. energy use patterns, and in other countries, provided that economic incentives and time are allowed to play a role. Energy use policies per se are of a secondary nature in the establishment of today's practices, but policies will be more important in the future. Energy consumption in the U.S. is compared with that in Sweden. DOE

N79-30803# Argonne National Lab., Ill.
EVALUATION OF SELECTED NEAR-TERM ENERGY-CONSERVATION OPTIONS FOR THE MIDWEST
A. R. Evans, C. S. Colsher, R. W. Hamilton, and W. A. Buehring Nov. 1978 172 p refs
(Contract W-31-109-eng-38)
(ANL/EES-TM-41) Avail: NTIS HC A08/MF A01

The potential for implementation of near-term energy conservation practices for the residential, commercial, agricultural, industrial, transportation, and utility sectors of the economy is evaluated for 12 states: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin. The information used to evaluate the magnitude of achievable energy savings includes regional energy use, the regulatory/legislative climate relating to energy conserva-

tion, technical characteristics of the measures, and their feasibility of implementation. Baseline information for an ongoing regional assessment of energy and environmental impacts in the Midwest is provided. DOE

N79-30804# California Univ., Berkeley. Lawrence Berkeley Lab. Dept. of Materials Science and Mineral Engineering.

MICROSTRUCTURE AND OPTICAL PROPERTIES OF BLACK CHROME BEFORE AND AFTER EXPOSURE TO HIGH TEMPERATURES

Carl M. Lampert Jan. 1979 15 p refs Presented at the 2d Ann. Conf. on Absorber Surfaces for Solar Receivers, Boulder, Colo., 24 Jan. 1979

(Contract W-7405-eng-48)

(LBL-8632; Conf-790120-2) Avail: NTIS HC A02/MF A01

Short term high temperature heat treatments were used to simulate stagnation conditions. Samples were annealed in both air and vacuum, which resulted in similar characteristics. Annealing in air appeared to mildly accelerate optical degradation at high temperatures. For short term heat treatments below 300 C the reflective and microstructural properties appeared to be unchanged. By in situ vacuum annealing of the coating above 400 C microscrystalline Cr2O3 was identified. By observation of diffraction patterns it was concluded that a Cr2O3 was transformed into crystalline Cr2O3. The Cr2O3 phase continued to grow at higher temperatures at the expense of chromium content. At temperatures above 500 C in vacuum, a new phase identified as Cr3O4 formed. It was found that black chrome failed optically between 500 to 600 C for 1 hour heat treatments in both air and vacuum; also the coating heated in air failed mechanically by peeling at 600 C. DOE

N79-30805# Battelle Columbus Labs., Ohio.

DEVELOPMENT OF A LOW-TEMPERATURE, LOW-COST, BLACK-LIQUID SOLAR COLLECTOR

D. K. Landstrom 1978 5 p refs Presented at the 3d Solar Heating and Cooling R and D Branch Contractors' Meeting, Washington D.C., 24 Sep. 1978

(Contract EG-77-C-04-4097)

(CONF-780983-14) Avail: NTIS HC A02/MF A01

A cost effective, high efficiency, low-temperature nonconcentrating black liquid type collector is presented. Whether this collector would have specific advantages when used as a thermal energy source for a heat pumps is analyzed. DOE

N79-30806# Sandia Labs., Albuquerque, N. Mex. Systems Analysis Div.

ANALYSIS OF COLLECTORS FOR PROCESS HEAT APPLICATIONS

James K. Linn Feb. 1979 25 p refs

(Contract EY-76-C-04-0789)

(SAND-78-1977) Avail: NTIS HC A02/MF A01

The economic viability of solar energy for industrial process heat applications depends directly on the collector array performance and cost. Various distributed solar collectors were evaluated in terms of solar availability, attainable performance and projected costs. Collectors were rank ordered in their projected cost effectiveness for future industrial process heat applications. DOE

N79-30807# Sandia Labs., Albuquerque, N. Mex.

GEOTHERMAL WELL TECHNOLOGY PROGRAM

S. G. Varnado 1978 8 p refs Presented at Workshop on Geothermal Drilling Fluids, Houston, Tex., 23 May 1978

(Contract EY-76-C-04-0789)

(SAND-78-1063; Conf-780580-1) Avail: NTIS HC A02/MF A01

A program aimed at developing drilling and completion techniques for geothermal wells is presented. The reduction of well costs by 25% by 1982 and by 50% by 1986 is discussed. Program justification which relates well cost to busbar energy cost and to power-on-line goals is presented. Technological deficiencies encountered when current rotary drilling techniques are used for geothermal wells are discussed. A program for correcting these deficiencies is described. DOE

N79-30808# Argonne National Lab., Ill.

EFFECTS OF THE PROPOSED NEW SOURCE PERFORMANCE STANDARDS: A COMPARATIVE ASSESSMENT OF THE ENERGY AND ECONOMIC IMPACT

Paul S. Farber and C. D. Livengood 1978 22 p refs Presented at the 71st Air Pollution Control Assoc. Meeting, Houston, Tex., 25 Jun. 1978

(Contract W-31-109-eng-38)

(ANL/EES-CP-6; Conf-780636-6) Avail: NTIS HC A02/MF A01

In order to study the effect of the proposed vis-a-vis existing, New Source Performance Standards (NSPS) a number of coal sources were chosen to adequately represent the various coal supply regions in the U.S. Power plant scenarios were chosen to reflect both the mine mouth type of power plant and the effects of interstate coal shipment. Case studies were performed in order to determine the least cost mix of coal type and control techniques (particulate, FGD, coal cleaning, and NO/sub x/) needed to meet present and proposed NSPS. Costs and energy usage for environmental control were derived on an incremental basis with respect to a 500 MWe output base power plant. DOE

N79-30809# TRW, Inc., McLean, Va. Energy Systems Planning Div.

METHODOLOGY FOR THE ANALYSIS OF INVESTMENT ALTERNATIVES TO STIMULATE DEVELOPMENT AND TECHNOLOGY TRANSFER FOR ENERGY TECHNOLOGIES

Sep. 1978 27 p refs

(Contract ET-78-C-05-5670)

(TID-28971) Avail: NTIS HC A03/MF A01

The incentives to encourage the development and commercialization of selected energy technologies are examined through a final model. A decision oriented approach was adopted in characterizing a typical company's response to implementation of a particular incentive. This approach is described in detail. A computer model that calculates net present values and internal rates of return for prescribed investments in manufacturing facilities is included. DOE

N79-30810# Thermo Electron Corp., Waltham, Mass.

ENERGY CONSERVATION OPPORTUNITIES IN COMMERCIAL APPLIANCES Final Report

J. R. Hurley Dec. 1978 281 p refs

(Contract W-7405-eng-26)

(ORNL/Sub-7261/1) Avail: NTIS HC A13/MF A01

A data base of energy consuming applicances in the commercial sector was established which identifies and rates the most promising development opportunities that would save significant amounts of energy on a national level. A detailed national inventory of 45 major appliances and their energy consumption was established for the year 1975. Thirty-four potential appliance improvements were identified, evaluated, and ranked. The major energy consuming appliances in the following functional use categories were identified, space heating and cooling, water heating, refrigeration, cooking, and lighting. The equipment in these categories was estimated to consume 87% of the total energy used in the commercial sector, with the remaining 13% consumed by equipment such as computers, business machines, laundry equipment, dishwashing, and other food service equipment. DOE

N79-30811# District of Columbia Bar Association, Washington, D. C.

INTERNATIONAL ENERGY CONSERVATION: COMPARATIVE LAW AND POLICY. PROCEEDINGS FROM THE 1978 INTERNATIONAL CONFERENCE ON ENERGY CONSERVATION

Feb. 1979 362 p refs Conf. held at Washington, D. C., 23-24 Feb. 1978; sponsored by DOE and Am. Soc. of Intern. Law

(CONF-780274) Avail: NTIS HC A16/MF A01

The policies and laws that highly industrialized nations have used and considered to meet the challenge of energy conservation were compared and discussed. The following countries participated in the conference: U.K.; Australia; Federal Republic of Germany; Japan; France; Canada Sweden; Italy; the Netherlands; and the U.S. The IEA and the Commision of the European Communities also participated. The conference format consisted of ministerial addresses to the conference, interspersed with panel discussions

focusing on energy conservation in transportation, industry, agriculture, and utilities; residential, commercial, and industrial buildings; and emergency situations. There was also a panel discussion on the role of government in energy conservation and energy information collection. The panels were composed of participating countries' representatives. DOE

N79-30812# Solar Systems of Virginia, Inc., Hampton.
COST EFFECTIVE SOLAR HOT WATER SYSTEM FOR ECONO-TRAVEL MOTOR HOTEL, CHESAPEAKE, VIRGINIA Final Report
Dec. 1978 17 p refs
(Contract EM-78-G-02-4663)
(COO-4663-1) Avail: NTIS HC A02/MF A01

The final report of a cost effective solar hot water heating system is presented. The description of the system along with the final breakdown performance data and payback time are given. The payback time for the installed system will be approximately four years instead of the 6.65 years estimated for the proposal. The additional savings is due to the reduction in the peak demand charge since the electric hot water heaters are not required to operate at the same time each morning as the dryers used for the laundry. The results shown in the hotel's monthly electricity bills indicate that this goal has been accomplished. DOE

N79-30813# Department of Energy, Washington, D. C. Office of Conservation and Solar Applications.
COMMUNITY SYSTEMS PROGRAM
Feb. 1979 55 p refs
(DOE/CS-0072) Avail: NTIS HC A04/MF A01

The Community Systems program of DOE through research, development, and demonstration will help communities develop and put into practice effective energy conservation programs. To do this, the program develops and demonstrates approaches to community energy conservation that: combine use of the energy resources available within a community, reducing reliance on external and scarce fuels; increase the use of fuel-efficient energy systems in supplying utility services; substitute energy systems that use nonscarce fuels for those that consume oil and natural gas; and reduce the end-use demand for energy through planning and development practices. A community is described here as any complex of buildings and open spaces used by large numbers of people and connected by networks for moving the people as well as messages, goods, and services. Before energy conservation in communities can have a national impact, comprehensive energy management must become an integral part of community processes. The Community Systems program is organized into three components--systems engineering products, planning and development products, and implementing mechanisms products. The activities within each program element are presented followed by a discussion of current site-specific prototype application projects (grid-connected systems, coal-using systems, district heating and cooling, heat pump systems, power plant retrofit, site design applications, subsystems development case studies, general development planning applications, and comprehensive community energy management pilot projects). Program management, organizational responsibilities, and budget are summarized. The current program activities and significant milestones are described. A list of publications resulting from Community Systems programs efforts is presented. DOE

N79-30814# Department of Energy, Washington, D. C. Office of State and Local Programs.
COMPREHENSIVE PROGRAM AND PLAN FOR FEDERAL ENERGY EDUCATION, EXTENSION AND INFORMATION ACTIVITIES Second Report to Congress
Jan. 1979 161 p refs
(Contracts EC-77-C-03-1446; EU-78-C-01-6280)
(DOE/CS-0071) Avail: NTIS HC A08/MF A01

This second annual Comprehensive Program and Plan for Federal Energy Education, Extension and Information Activities continues to survey federal outreach programs, to report on several considerations important to their effectiveness, and to provide a plan for their improved coordination. It provides individual Americans with the capability they need to adopt energy-saving measures. Outreach programs provide information and technical assistance tailored to communicate the importance of changes in energy consumption patterns; the energy and renewable-fuel options available; and the associated short-and long-term cost savings. Thirteen Federal departments and agencies have reported 68 programs dedicated in whole or in part to to energy-outreach activities. They describes in detail these energy-conservation programs and the use of renewable fuels; addresse procedures for minimizing potential conflict of federal energy education, extension, and information activities with those offered by the private sector, the relationship of these activities to other federal assistance and incentive programs, and procedures for evaluating the effectiveness of federal energy education, extension, and information efforts. The final chapter presents a plan of action for the coming year through which increased coordination of federal energy education, extension, and information activities will be sought. DOE

N79-30815# Department of Energy, Washington, D. C. Energy Information Administration.
PROJECTIONS OF ENERGY SUPPLY AND DEMAND FOR THE 1978-1979 WINTER HEATING SEASON
David T. Hulett Nov. 1978 43 p refs
(DOE/EIA-0102/33) Avail: NTIS HC A03/MF A01

National projections were made for petroleum, natural gas, and coal based on an economic assumption that reflects moderate growth in real GNP of 2.6 percent in 1979, normal weather conditions, and no major disruption in foreign or domestic supplies. Range of these projections based on legitimate real work uncertainties are presented. The projections showed that supplies together with realistic inventory drawdown strategies and feasible import levels would be adequate to meet the foreseen consumption requirements for all fuels for the winter, although there were some indications of possible tightness in the supply and demand balances for each major fuel. DOE

N79-30816# Department of Energy, Washington, D. C. Office of Policy and Evaluation.
ROLE OF THE STATES IN ENERGY
Sep. 1978 42 p refs
(DOE/PE-0009) Avail: NTIS HC A03/MF A01

Some 44 separate energy programs and policies which involve states, and are administered by 8 Federal departments, are examined. Of these programs, 17 received primary emphasis and were selected for further detailed study, and were divided into conservation programs/policies and supply programs/policies. Field studies in 8 selected Case Study States were selected so that they would be representative of the problems and opportunities associated with energy production and consumption. The states were Alabama, California, Colorado, Illinois, Massachusetts, Minnesota, New York, and Texas. The study approach described and analyzed state energy capabilities, existing problems and opportunities, and the Federal government's role in aiding and improving state energy capabilities. The range of Federal energy programs and policies is outlined, and the burdens these programs placed on the states are explored. DOE

N79-30817# Department of Energy, Washington, D. C. Energy Information Administration.
RECENT ENERGY CONSUMPTION TRENDS IN EUROPEAN ECONOMIC COMMUNITY COUNTRIES
Mark Rodekohr Jan. 1979 56 p refs
(DOE/EIA-0103/16) Avail: NTIS HC A04/MF A01

A descriptive analysis of EEC energy comsumption and production in the pre- and post-embargo period from 1973 to 1976 is provided. Primarily aggregate EEC data is presented, however, some individual country data is shown to highlight some of the more important trends. Sectoral consumption is shown along with the appropriate measure of economic activity and other important indicators of energy consumption. From 1973 to 1975, net imports to the EEC declined by 140 metric tons of oil equivalent (MTOE) of which 75 MTOE was due to a decline in total energy requirements (TER) and the remaining 65 MTOE was due to an increase in indigenous production. The trends in TER are illustrated in a figure and table, where the sectoral consumption levels are shown. DOE

N79-30818# California Univ., Berkeley. Lawrence Berkeley Lab.
ENERGY CONSERVATION: POLICY ISSUES AND END-USE

SCENARIOS OF SAVINGS POTENTIAL. PART 6. END-USE ENERGY CONSERVATION DATA BASE AND SCENARIOS
Sep. 1978 398 p refs
(Contract W-7405-eng-48)
(LBL-7896-Pt-6) Avail: NTIS HC A17/MF A01

End-use energy conservation scenarios discussed show the combined effect on energy consumption of implementing a number of conservation measures. The scenarios serve two overall purposes. First, they provide a contrast of a series of nonconservation cases based on assumption of growth rate and appliance saturation with conservation cases on similar assumptions. Second, they provide detailed data and documentation for the savings potential for each conservation measure, the stock affected, and the calculation of total energy savings. Included are conservation measures of both a behavioral nature and technological nature. Quantitative estimates of energy consumption and conservation potential in the major residential and commercial end uses, transportation modes, and industrial subsectors made. For each measure and for the total scenario a base case and a conservation case were computed. DOE

N79-30819# Iowa State Univ. of Science and Technology, Ames. Heat Transfer Lab.
ENERGY CONSERVATION VIA HEAT TRANSFER ENHANCEMENT Quarterly Progress Report, 1 Jul. - 30 Sep. 1978
A. E. Bergles, G. H. Junkhan, and R. L. Webb Oct. 1978 34 p refs
(Contract EG-78-S-02-4649)
(COO-4649-3) Avail: NTIS HC A03/MF A01

Progress on the subject contract for the period July 1, 1978 to September 30, 1978, is discussed. Discussions with manufactures of heat exchange equipment; as well as R and D personnel, were held in order to identify further examples of commercial equipment utilizing enhanced or augmented heat transfer. A listing of 127 manufacturers of enhanced heat transfer articles is presented. An additional 400 citations were added to the computerized file of literature. Many new full-size copies were obtained. The patent search has been continued, and progress has been made in identifying the patent classes and sub-classes of major interest. Summaries of preliminary work in two Key Application Areas are reported: waste heat recovery and sensible thermal energy storage. Key Technology Areas have also been identified, and preliminary reports on enhancement by free-stream turbulence and optimization of integral inner-fin tubes have been prepared. A number of other Key Areas have been identified. DOE

N79-30820# Oak Ridge National Lab., Tenn.
COMPUTER SIMULATION OF HEATING AND COOLING OF VENTILATION AIR FOR A PASSIVE SOLAR HOUSE
G. A. Cristy 1979 13 p refs Presented at 3d Natl. Passive Solar Conf., San Jose, Calif., 11 Jan. 1979
(Contract W-7405-eng-26)
(CONF-790106-1) Avail: NTIS HC A02/MF A01

A computer model was developed to analyze the performance of a proposed system for moderating the temperatures of ventilation air for a semi-buried passive solar house using a rock bed installed outside the insulation on the three buried walls of the house. The soil outside the rock bed would be covered with insulation to allow the soil to augment the thermal mass of the rock bed. The ventilation air would be warmed in winter by passing through the rock bed before entering the house. This would cool the rock bed and the soil adjacent to it. In summer, the intake air for daytime would be cooled by passing over the cooled rock bed. Cool night-time air would be used to cool the thermal mass of the house and to backflush the rock bed. Thus, the system takes advantage of both the annual and diurnal cycles. DOE

N79-30821# Argonne National Lab., Ill.
USE OF RECIPROCATING ENGINES IN COMPRESSED AIR ENERGY STORAGE POWER PLANTS
G. T. Kartsounes and J. G. Daley 1978 36 p refs Presented at CAES Technol. Symp., Pacific Grove, Calif., 15 May 1978
(Contract W-31-109-eng-38)
(CONF-780599-4) Avail: NTIS HC A03/MF A01

The application of reciprocating engines to compressed air energy is described. The expected advantages compared to conventional turbines and compressors are reduced reservoir size and cost, reduced equipment cost, reduced compression energy, increased overall plant efficiency, and increased energy storage effectiveness. The performance of possible engine and plant configurations are presented. One possible configuration is the use of a reversible expander/compressor engine; another is a hybrid reciprocating engine-turbomachinery concept. Capital and operating costs are also estimated and compared with that of conventional CAES plant designs. DOE

N79-30822# Argonne National Lab., Ill.
PRELIMINARY EVALUATION OF THE USE OF HYDRAULIC AIR COMPRESSORS IN WATER-COMPENSATED RESERVOIR COMPRESSED AIR STORAGE POWER PLANTS
F. W. Ahrens and J. A. Berghmans 1978 23 p refs Presented at CAES Technol. Symp., Pacific Grove, Calif., 15 May 1978
(Contract W-31-109-eng-38)
(CONF-780599-2) Avail: NTIS HC A02/MF A01

An air compression system for CAES applications, based on the hydraulic compressor principle, is described and evaluated. In addition to yielding a more efficient use of energy from the base power plant, due to isothermal air compression, the hydraulic air compressor does not require the conventional intercoolers and it replaces the air compressors with water pumps. Using performance characteristics predicted with an analytical model, a hydraulic compression system for a CAES plant is designed and compared with an equivalent conventional air compression system. The hydraulic air compressor-based CAES system uses less compression energy but can be costly due to the number and size of the water shafts required. DOE

N79-30823# Brookhaven National Lab., Upton, N. Y.
MULTIOBJECTIVE ANALYSIS IN A NATIONAL ENERGY SYSTEM MODEL
Joseph Schank 1978 7 p refs Presented at 9th Conf. on Modeling and Simulation, Pittsburgh, Pa., 27 Apr. 1978
(Contract EY-76-C-02-0016)
(BNL-24371; Conf-780450-2) Avail: NTIS HC A02/MF A01

An automated methodology for the analysis described is developed. Both the previous and automated procedures are executed upon a variant of the 1985 National Energy plan scenario and the respective results are compared. DOE

N79-30824# Pennsylvania Univ., Philadelphia.
STATUS OF ENERGY-MANAGEMENT ACADEMIC PROGRAMS IN US INSTITUTIONS OF HIGHER EDUCATION: EXECUTIVE SUMMARY
L. Eisenberg, C. Daspit, and G. Shimamoto Sep. 1978 29 p
(Contract EE-77-S-02-4465)
(COO-4465-2-Exec-Summ) Avail: NTIS HC A03/MF A01

A formal course of study, leading to the bachelor's or higher degree, which addresses the range of energy management issues is described. Some 2,602 U.S. institutions of higher education were surveyed in order to identify energy management programs and related courses. More detailed information was sought from respondents who indicated that they had, or planned to offer, such a program. Ten existing, and planned, programs were identified. In addition, 303 institutions were found to offer one or more courses on some aspect of energy management. The 10 existing programs were classified as undergraduate, engineering focused, or general/diversified. They were analyzed in terms of their administrative organization, enrollment and number of degrees awarded to date, availability of financial support for graduate students, program goals and curriculum design. DOE

N79-30825# Mathematica, Inc., Princeton, N. J.
ENERGY FROM URBAN WASTES: REPORT ON A FOCUS GROUP DISCUSSION
W. E. Nicholson 10 Nov. 1978 42 p
(Contract EV-78-C-01-6388)
(DOE/TIC-10022) Avail: NTIS HC A03/MF A01

A qualitative assessment of the opinion concerning the commercialization potential of urban waste technologies is presented. Barriers to the commercialization of the urban waste energy production systems that were discussed include problems in serving long-term contracts, uncertainty about environmental laws, problems with the supply of refuse, disposal and use of

residue, uncertainties about future tax laws, legal barriers, technical reliability, and citizen dissent. DOE

N79-30826# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOLAR MODULE CURVE TRACER
A. R. Millner 7 Feb. 1979 22 p
(Contract EY-76-C-02-4094)
(COO-4094-35) Avail: NTIS HC A02/MF A01

The solar module curve tracer, a hand portable, battery powered instrument, is used to measure the output I-V characteristics of a solar module in a solar cell array. A physical description of the instrument, operating procedure, and circuit theory are presented. DOE

N79-30827# Sandia Labs., Albuquerque, N. Mex.
METHODOLOGY FOR DETERMINING THE ECONOMIC FEASIBILITY OF RESIDENTIAL OR COMMERCIAL SOLAR ENERGY SYSTEMS
Audrey M. Perino Jan. 1979 38 p
(Contract EY-76-C-04-0789)
(SAND-78-0931) Avail: NTIS HC A03/MF A01

A methodology for analyzing the economic feasibility of solar energy systems based upon a life cycle costing criterion is presented. Both residential and commercial solar energy systems are included in the analysis. The analysis provides for a comparison between solar and conventional energy systems. DOE

N79-30828# Los Alamos Scientific Lab., N. Mex.
ECONOMIC PERFORMANCE: EVALUATIONS FOR SOLAR ENERGY
James Frederick Roach and S. A. Noll 1979 11 p refs Presented at the 6th Energy Technol. Conf. and Exposition, Washington, D.C., 26 Feb. 1979
(Contract W-7405-eng-36)
(LA-UR-79-901; Conf-790213-3) Avail: NTIS HC A02/MF A01

The LASL/UNM economic performance methodology--computer code, is reported. The inputs, sets of evaluative procedures, and outputs associated with the methodology/code are discussed. Present status plus on going modifications to the various components are highlighted. The utility of the LASL/UNM code is demonstrated through illustrative examples. DOE

N79-30829# Eidgenoessisches Flugzeugwerk, Emmen (Switzerland). Research and Testing Dept.
SOFTWARE DEVELOPMENT FOR STEADY STATE ANALYSIS OF A REVERSE-RANKINE CYCLE HEAT PUMP, VOLUME 1. PART 1: REPORT ON PROBLEM ANALYSIS. PART 2: PROGRAMMER'S MANUAL Final Report
Marcel Schleicher Paris ESA Nov. 1978 89 p refs 2 Vol.
(Contract ESTEC-3447/77/NL-PP(SC))
(F&W-FO-1439-Vol-1; ESA-CR(P)-1162-Vol-1) Avail: NTIS HC A05/MF A01

Software for the analysis of the steady state performance of a Reverse-Rankine heat pump cycle was developed. Two different configurations were defined. The first configuration called Supplementary Cooling Assembly consists of a heat pump loop whereby heat for evaporation of the refrigerant is taken from a core loop fluid passing through the evaporator and heat given off by the condensing refrigerant is transferred to another core loop fluid passing through the condenser. This system is to be built into a larger fluid loop system. The second configuration called refrigerator is very similar to a commercial refrigerator. The software developed allows for analyzing the influence of the relevant parameters on the performance of the heat pump. A discussion of user requirements and options is also included. This document contains the Report on the Problem Analysis and the Programmer's Manual. The User's Manual is contained in a separate document. Author (ESA)

N79-30830# Eidgenoessisches Flugzeugwerk, Emmen (Switzerland). Research and Testing Dept.
SOFTWARE DEVELOPMENT FOR STEADY STATE ANALYSIS OF A REVERSE-RANKINE CYCLE HEAT PUMP, VOLUME 2. PART 3: USER'S MANUAL Final Report
Marcel Schleicher Paris ESA Nov. 1978 29 p 2 Vol.
(Contract ESTEC-3447/77/NL-PP(SC))
(F&W-FO-1440-Vol-2; ESA-CR(P)-1162-Vol-2) Avail: NTIS HC A03/MF A01

Software for the analysis of the steady state performance of a Reverse-Rankine heat pump cycle was developed. Two different configurations were defined. The first configuration called Supplementary Cooling Assembly consists of a heat pump loop whereby heat for evaporation of the refrigerant is taken from a core loop fluid passing through the evaporator and heat given off by the condensing refrigerent is transferred to another core loop fluid passing through the condenser. This system is to be built into a larger fluid loop system. The second configuration called Refrigerator is very similar to a commercial refrigerator. The software developed allows for analyzing the influence of the relevant parameters on the performance of the heat pump. This document contains the user's manual. The information necessary to run the programs is given along with a description of the input files to be prepared by the user. The report on the Problem Analysis and the Programmer's Manual are contained in a separate document. Author (ESA)

N79-30831# Electricite de France, Chatou. Dept. d'Optimisation et Automisation des Processus.
ENERGY ANALYSIS OF THE HELIO-THERMAL-ELECTRIC CONVERSION [ANALYSE ENERGETIQUE DE LA CONVERSION HELIO-THERMO-ELECTRIQUE]
T. S. Trans Feb. 1977 22 p In FRENCH
(P-77/P40/242) Avail: NTIS HC A02/MF A01

A precise description of the relationship of the sun to the earth in terms of energy is given. The physical position of the sun for any point on the earth is specified. Optical concentration of solar energy is discussed. A system for solar heat conversion is outlined. Thermodynamic conversion of solar energy is also mentioned. Author (ESA)

N79-30832# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
RATIONAL ENERGY UTILIZATION IN COKE-OVEN-PLANT OPERATIONS Final Report
Lutz Trepte and Hermann Bankwitz Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1977 209 p refs In GERMAN; ENGLISH summary
(Contract BMFT-ETS-400-A; DFVLR-BPT-03-E5-110A)
(BMFT-FB-T-77-72) Avail: NTIS HC A10/MF A01; ZLDI, Munich DM 43,45

The economic use of energy in coke-oven-plant operations is discussed. In the process of high temperature coking more than 880 percent the heat applied remains as sensible heat in coke and raw gas. Due to present practice in coke plants these amounts of heat have to be considered as energy losses. Technological processes such as dry quenching of coke or methods for heat-recycling from raw gas could save 430,000 Gcal of energy per year in an average sized plant. This energy could be reused internally or provided to external consumers. In the first case the specific energy consumption of a traditional coke-plant would drop by 1/3. Considering the quantitative coke production in the Federal Republic of Germany there are considerable amounts of energy not reused. Because of the concentration of coke production in some highly populated areas it can be favorable to exchange energy between coke-plants and industrial plants or to use the heat energy gained as waste heat from coke-plants in large heating systems (e.g. multi-building heating).
Author (ESA)

N79-30833# Deutscher Naturschutzring, e.V., Bonn-Oberkassel (West Germany).
STATEMENT AND COMPARISON BETWEEN DIFFERENT STUDIES ON ENERGY REQUIREMENT Final Report
Hans Hammer, Peter Schmidt-Burr, Heinz W. Simoneit, and Erwin Deischl Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1977 164 p refs In GERMAN; ENGLISH summary Prepared in cooperation with Wirtschaft u. Infrastruktur G.m.b.H. und Co. Planungs-Kg, Munich
(Contract BMFT-ET-5207-A)
(BMFT-FB-T-77-92) Avail: NTIS HC A08/MF A01; ZLDI, Munich DM 29,40

A comparison between two energy requirement investigations on new energy systems ordered by the German government as well as a statement on the results are presented. An analysis of the demand for long distance heat supply is included. Possibilities

for energy conservation by a more efficient utilization of energy and the possible use of new sources of energy are shown.
Author (ESA)

N79-30834# Engins Matra, Velizy (France). Automatisme Dept.
STUDY OF SYSTEM IMPLICATIONS OF HIGH SPEED FLYWHEELS AS ENERGY STORAGE DEVICES ON SATELLITES, VOLUME 1 Final Report
H. Nghia Nguyen and Francois Mariau Oct. 1978 68 p refs 2 Vol.
(Contract ESA-3261/77/NL-AK)
(Rept-30/1020-Vol-1; ESA-CR(P)-1168-Vol-1) Avail: NTIS HC A04/MF A01

The feasibility of integrated energy storage and attitude control systems using high speed flywheels is demonstrated. The impact of magnetic bearing technologies on these flywheel applications is assessed. The flywheel designs for different mission objectives are briefly reviewed to establish the level of technology required. In particular, power and attitude control sub-systems are evaluated to characterize their functional interaction. Proposed wheel arrays are presented and compared to alternative electrochemical systems. These comparisons indicate that in terms of mass, volume, and reliability, flywheels for satellite applications are preferable. The concise design synthesis of the integrated energy storage and attitude control system concept is presented as well as the technical indexes. Author (ESA)

N79-30835# Engins Matra, Velizy (France). Automatisme Dept.
STUDY OF SYSTEM IMPLICATIONS OF HIGH SPEED FLYWHEELS AS ENERGY STORAGE DEVICES ON SATELLITES, VOLUME 2
H. Nghia Nguyen and Francois Mariau Oct. 1978 262 p refs 2 Vol.
(Contract ESA-3261/77/NL-AK)
(Rept-30/1020-Vol-2; ESA-CR(P)-1168-Vol-2) Avail: NTIS HC A12/MF A01

The feasibility of integrated energy storage and attitude control systems using high speed flywheels is demonstrated. The impact of magnetic bearing technologies on these flywheel applications is assessed. The flywheel designs for different mission objectives are briefly reviewed at the level of technology required. In particular, power and attitude control sub-systems are evaluated to characterize their functional interaction. Proposed wheel arrays are presented and compared to alterative electrochemical systems. These comparisons indicate that in terms of mass, volume, and reliability flywheels for satellite applications are preferable. This report exists as two volumes. Volume 1 contains the concise design synthesis of the Integrated Energy Storage and Attitude Control System concept. Volume 2 contains the technical appendixes. Author (ESA)

N79-30836# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Trauen (West Germany). Inst. fuer Chemische Antriebe und Verfahrenstechnik.
PHOTOLYTIC DECOMPOSITION OF WATER INTO OXYGEN AND HYDROGEN AS AN ALTERNATIVE ENERGY SOURCE FOR HOUSEHOLDS AND SMALL CONSUMERS
Wolfgang U. Wendekamm Jan. 1978 48 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-582)
(DLR-FB-78-17) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 19,90

The photolytic decomposition of water into oxygen and hydrogen is one of the possible alternatives for the transformation of solar energy into storable secondary energy for practical utilization by households and small consumers. After a survey of the possible cycles of water decomposition, the chemical and physical fundamentals of the photolytic accomposition of water using inorganic catalysts and sensitizers are described. Finally, a total house energy supply system is presented as one illustration of the application possibilities. Author (ESA)

N79-30837# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
GEOTHERMAL ENERGY MARKET STUDY ON THE ATLANTIC COASTAL PLAIN. A REVIEW OF RECENT ENERGY PRICE PROJECTIONS FOR TRADITIONAL SPACE HEATING FUEL, 1985-2000
Richard Weissbrod and William Barron Mar. 1979 47 p refs (Contract EX-76-A-36-1008)
(PB-294013/8; APL/JHU/GEMS-005; APL/JHU/QM-79-016; MCGER-79/0001) Avail: NTIS HC A03/MF A01 CSCL 21D

In order to develop an initial estimate of the potential competitiveness of low-temperature (45 to 100 C) geothermal resources on the Atlantic Coastal Plain, available energy price projections are reviewed and compared. Since low-temperature geothermal energy competes primarily for the space and process heating markets currently held by petroleum, natural gas, and electricity, projected trends in the real prices for these fuels were examined. GRA

N79-30838# National Technical Information Service, Springfield, Va.
THERMIONIC ENERGY CONVERSION, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Jun. 1977 - May 1979
William E. Reed Jun. 1979 112 p
(NTIS/PS-79/0596) Avail: NTIS HC $28.00/MF $28.00 CSCL 10B

Research on thermionic power generation, power plant design, converter design, and basic research on thermionic materials are cited in the bibliography. Spacecraft applications are included. This updated bibliography contains 106 abstracts. Author

N79-30839# Federal Trade Commission, Washington, D.C. Bureau of Economics.
ECONOMIC STRUCTURE AND BEHAVIOR IN THE NATURAL GAS PRODUCTION INDUSTRY
Joseph P. Mulholland Feb. 1979 179 p refs
(PB-294610/1; FTC/BE-79/04) Avail: NTIS HC A09/MF A01 CSCL 10A

The competitive potential of the natural gas production industry is evaluated. Attention focuses primarily on seller structure within the gas sector, on both a nationwide and regional basis. In a behavioral context, charges of monopolistic supply restraint by the major producers are evaluated by examining the ownership pattern of nonproducing leases in the Federal offshore area. Since Federal price regulation has had a pervasive effect on the gas sector's performance up to the present time, the report's objective is not to evaluate the industry's past performance but, rather, to gauge its potential for workable competition in the absence of price regulation in the future. GRA

N79-30840# United Nations Industrial Development Organization, Vienna (Austria).
INTERNATIONAL FORUM ON APPROPRIATE INDUSTRIAL TECHNOLOGY. APPROPRIATE TECHNOLOGY FOR RURAL ENERGY SUPPLY IN DEVELOPING COUNTRIES
T. Turner Oct. 1978 269 p refs Forum held at New Delhi/Anand, 20-30 Nov. 1978
(PB-294602/8) Avail: NTIS HC A12/MF A01 CSCL 10A

Trends in the search for appropriate energy technologies are described. Situation of the issues of energy supply for integrated rural development within an institutional and international framework was discussed. Recommendations are given.
GRA

N79-30262*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. DSN Engineering Section.
COMPARISON OF TWO TOTAL ENERGY SYSTEMS FOR A DIESEL POWER GENERATION PLANT
V. W. Chai *In its* The Deep Space Network 15 Aug. 1979 p 89-93 ref (For primary document see N79-30248 21-12)
Avail: NTIS HC A06/MF A01 CSCL 10B

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N79-30841 Commission of the European Communities, Luxembourg.

RESULTS OF ENVIRONMENTAL RADIOACTIVITY MEASUREMENTS IN THE MEMBER STATES OF THE EUROPEAN COMMUNITY FOR AIR-FALLOUT-WATER-MILK (1975-1976)

1978 328 p refs In DANISH, ENGLISH, FRENCH, ITALIAN, DUTCH, GERMAN

(EUR-5911; ISBN-92-825-0295-3) Copyright. Avail: CEC, Brussels BFR 1150, DKR 203, DM 74, FF 167, LIT 31,000, FL 79, UKL 19, USD 36

European community environment radiation contamination data for 1975 and 1976 are presented. Air, fallout, surface water, and milk were examined by the stations in change of the surveillance of environmental radioactivity in the member states. Special emphasis is placed on the results of measurements of specific radionuclides, but data on total beta activity is also presented to ensure continuity and provide comparative valves. Results for each specific country are discussed. Author (ESA)

N79-30842*# Environmental Research and Technology, Inc., Concord, Mass.

EVALUATION OF THE CAPABILITIES OF SATELLITE IMAGERY FOR MONITORING REGIONAL AIR POLLUTION EPISODES

James C. Barnes, Clinton J. Bowley, and Hsiao-hua K. Burke Aug. 1979 97 p refs

(Contract NAS1-15307)

(NASA-CR-159107) Avail: NTIS HC A05/MF A01 CSCL 13B

A comparative analysis of satellite visible channel imagery and ground based aerosol measurements is carried out for three cases representing a significant pollution episodes based on low surface visibility and high sulfate levels. The feasibility of detecting pollution episodes from space is also investigated using a simulation model. The model results are compared to quantitative information derived from digitized satellite data. The results show that when levels are > or = 30 micrograms/cu, a haze pattern that correlates closely with the area of reported low surface visibilities and high micrograms sulfate levels can be detected in satellite visible channel imagery. The model simulation demonstrates the potential of the satellite to monitor the magnitude and areal extent of pollution episodes. Quantitative information on total aerosol amount derived from the satellite digitized data using the atmospheric radiative transfer model agrees well with the results obtained from the ground based measurements. K.L.

N79-30843*# Oregon State Univ., Corvallis. Dept. of General Science.

ASSESSMENT OF THE IMPACT OF INCREASED SOLAR ULTRAVIOLET RADIATION UPON MARINE ECOSYSTEMS Annual Progress Report, 8 Dec. 1977 - 7 Dec. 1978

Robert C. Worrest and Henry VanDyke Dec. 1978 48 p refs (Contract NAS9-14860)

(NASA-CR-160305) Avail: NTIS HC A03/MF A01 CSCL 13B

Reduction of the earth's ozone layer, with a resultant increase in transmission of solar ultraviolet radiation in the 290 to 320 nm waveband (UV-B), via space shuttle operations through the stratosphere is considered. It is shown that simulated solar ultraviolet radiation can, under experimental conditions, detrimentally affect the marine organisms that form the base of the food web of oceanic and estuarine ecosystems. Whether a small increase in biologically harmful ultraviolet radiation might overwhelm these mechanisms and produce changes that will have damaging consequences to the biosphere is discussed. The potential for irreversible damage to the productivity, structure and/or functioning of a model estuarine ecosystem by increased UV-B radiation and whether these ecosystems are highly stable or amenable to adaptive change is studied. Data are provided to assess the potential impact upon marine ecosystems if space shuttle operations contribute to a reduction of the stratospheric ozone layer and the sensitivity of key community components to increased UV-B radiation is examined. A.W.H.

N79-30844*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

PROGRAMS FOR CALCULATING CELL PARAMETERS IN ELECTRON AND X-RAY DIFFRACTION

George Polkowski (LFE Corp., Richmond, Calif.), K. G. Snetsinger, and Neil H. Farlow Aug. 1979 57 p refs

(NASA-TP-1529; A-7761) Avail: NTIS HC A04/MF A01 CSCL 13B

Ten programs for calculating cell parameters from single crystal electron diffraction patterns are presented. Most of the programs, written for use with a programmable desk calculator, are also applicable to X-ray diffraction work. The programs can be used to calculate d-spacings from electron diffraction plate measurements, and to determine cell data (including interplanar angles and zone angles) for all crystal systems. A program for rhombohedral-hexagonal conversions and one for matching crystal data from standards with apparent crystal parameters found in diffraction patterns are included. Because they allow rapid determination of data not present in X-ray listings or elsewhere in the literature, the programs facilitate identification of unknowns. K.L.

N79-30845*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

SUMMARY OF SOUTHEASTERN VIRGINIA URBAN PLUME MEASUREMENT DATA FOR AUGUST 4 AND 5, 1977

Gerald L. Gregory, ed. and H. Scott Wagner, ed. Sep. 1979 110 p refs

(NASA-TM-78822; L-12683) Avail: NTIS HC A06/MF A01 CSCL 13B

The measurement program was conducted to define the characteristics of the Southeastern Virginia urban plume with emphasis on the photooxidant species. The measurement area was a rectangle approximately 200 km by 60 km centered in the Hampton Roads area of Tidewater Virginia. This area includes the cities of Norfolk, Virginia Beach, Chesapeake, Newport News, and Hampton. The data set presented includes aircraft measurements for ozone, nitrogen oxides, carbon monoxide, methane, and meteorological parameters such as dewpoint temperature. Surface level data for ozone are presented for 10 stations located throughout the test area. Comprehensive meteorological data from existing National Weather Service stations and special locations selected for the urban plume program are summarized. G.Y.

N79-30846# Argonne National Lab., Ill. Div. of Environmental Control Technology.

ENVIRONMENTAL CONTROL IMPLICATIONS OF INCREASED COAL UTILIZATION UNDER THE NATIONAL ENERGY PLAN

Myron Gottlieb (DOE, Washington, D.C.), C. D. Livengood, and K. E. Wilzbach 1978 18 p refs Presented at the 71st Air Pollution Control Assoc. Meeting, Houston, Tex., 25 Jun. 1978

(Contract W-31-109-eng-38)

(ANL/EES-CP-10; Conf-780636-9) Avail: NTIS HC A02/MF A01

The development, selection, and use of proper environmental controls for the increased utilization of coal is discussed. The complexity of the regulatory and control issues for environmental quality are presented with the impacts they will incur on the coal industry and population. A.W.H.

N79-30847# Ames Lab., Iowa.

COMPUTERIZED TECHNIQUES FOR DIGITAL FILTERING AND SPECTRAL DECOMPOSITION WITH APPLICATIONS TO NUCLEAR MAGNETIC RESONANCE

P. DuBois Murphy Feb. 1979 89 p refs

(Contract W-7405-eng-82)

(IS-4620) Avail: NTIS HC A05/MF A01

A digital filtering technique using both a bandpass filter and an exponentail filter is described. The properties of Lorentzian and Gaussian lineshapes are discussed. A procedure for decomposing nuclear magnetic resonance absorption spectra with overlapping lines into Lorentzian and Gaussian components is also described. Two FORTRAN computer programs which implement concepts developed are presented. DOE

N79-30848# Southern Research Inst., Birmingham, Ala.

STUDY OF ELECTROSTATIC PRECIPITATORS INSTALLED ON OIL-FIRED BURNERS Final Report

Alan H. Dean Jun. 1978 185 p refs

(EPRI Proj. 413-1)

(EPRI-FP-792-Vol-2) Avail: NTIS HC A09/MF A01

The use of electrostatic precipitators for collection of effluent from oil-fired boilers in the utility industry is discussed. Basically, the information is presented in two sections-literature survey and industry survey. The objectives were to document usage of electrostatic precipitators on oil-fired utility boilers, to present any available design and performance data, to discuss the operating experience, and to present procedure employed to remedy problems identified. A detailed report is presented concerning costs of an electrostatic precipitator for a hypothetical 100 MW oil-fired utility plant; costs were based on year 1971 and are updated to 1976. DOE

N79-30849# Environmental Protection Agency, Denver, Colo. Office of Public Awareness.
PROFILE OF ENVIRONMENTAL QUALITY: REGION 8, COLORADO, MONTANA, NORTH DAKOTA, SOUTH DAKOTA, UTAH, WYOMING
Oct. 1978 32 p
(PB-295519/3) Avail: NTIS HC A03/MF A01 CSCL 13B

A brief overview of some of the problems which affect environmental quality in the Region 7 states of Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming. EPA's programs aimed at dealing with these problems are also discussed. GRA

N79-30850# SCS Engineers, Long Beach, Calif.
SELECTED BIODEGRADATION TECHNIQUES FOR TREATMENT AND/OR ULTIMATE DISPOSAL OF ORGANIC MATERIALS Final Report
Mar. 1979 379 p refs
(Contract EPA-68-03-2475)
(PB-295394/1; EPA-600/2-79-006) Avail: NTIS HC A17/MF A01 CSCL 13B

Organic constituents in aqueous process effluent from various industries often have properties not readily treatable by conventional biological processes. These properties include high COD/BOD ratios, low nutrient content, biocidal content, marginally degradable constituents, and a tendency toward highly variant concentrations (shock loading). For this reason, research was conducted to identify, characterize, and compare types of biological treatment processes and operational methods that successfully handle problematic organic industrial waste. GRA

N79-30851# Environmental Protection Agency, Ann Arbor, Mich. Standards Development and Support Branch.
A PRELIMINARY EXAMINATION OF THE REPEATABILITY OF THE HEAVY-DUTY TRANSIENT DYNAMOMETER EMISSION TEST
William B. Clemmens Jun. 1978 10 p ref
(PB-293830/6; HDV-78-06) Avail: NTIS HC A02/MF A01 CSCL 13B

The repeatability (errors due to lack of precision) of the heavy duty transient procedure was examined. GRA

N79-30852# Wyoming Univ., Laramie.
METHODS DEVELOPMENT FOR ASSESSING AIR POLLUTION CONTROL BENEFITS. VOLUME 2: EXPERIMENTS IN VALUING NON-MARKET GOODS: A CASE STUDY OF ALTERNATIVE BENEFIT MEASURES OF AIR POLLUTION CONTROL IN THE SOUTH COAST AIR BASIN OF SOUTHERN CALIFORNIA Final Report, Oct. 1976 - Oct. 1978
David S. Brookshire, Ralph C. dArge, William D. Schulze (Univ. of Southern Calif., Los Angeles), and Mark A. Thayer (New Mexico Univ., Albuquerque) Feb. 1979 233 p refs
(Grant EPA-R-805059-01)
(PB-293616/9; EPA-600/5-79-001B-Vol-2) Avail: NTIS HC A11/MF A01 CSCL 06F

The empirical results obtained from two experiments to measure the health and aesthetic benefits of air pollution control are presented. Each experiment involved the same six neighborhood pairs, where the pairings were made on the basis of similarities in housing characteristics, socio-economic factors, distances to beaches and services, average temperatures, and subjective indicators of housing quality. Data on actual market transactions, as registered in single-family residential property transactions, and on stated preferences for air quality, as revealed in neighborhood surveys, were collected. Given various assumptions on income, location, aggregation by areas, specific housing characteristics, and knowledge of the health effects of air pollution, both the survey and the property value experiments yielded estimates of willingness to pay for an improvement. GRA

N79-30853# Wyoming Univ., Laramie.
METHODS DEVELOPMENT FOR ASSESSING AIR POLLUTION CONTROL BENEFITS. VOLUME 3: A PRELIMINARY ASSESSMENT OF AIR POLLUTION DAMAGES FOR SELECTED CROPS WITHIN SOUTHERN CALIFORNIA Final Report, Oct. 1976 - Oct. 1978
Richard M. Adams, Narongsakdi Thanavibulchai, and Thomas D. Crocker Feb. 1979 109 p refs
(Grant EPA-R-805059-01)
(PB-293617/7; EPA-600/5-79-001C-Vol-3) Avail: NTIS HC A06/MF A01 CSCL 06F

The economic benefits that would accrue from reductions in oxidant/ozone air pollution-induced damages to 14 annual vegetable and field crops in southern California are investigated. Using the analytical perspective of economics, the study provides an up-to-date review of the literature on the physical and economic damages to agricultural crops from air pollution. In addition, methodologies are developed permitting estimation of the impact of air pollution-induced price effects; input and output substitution effects, and risk effects upon producer and consumer losses. Estimates of the extent to which price effects contribute to consumer losses are provided. GRA

N79-30854# Harvard Univ., Cambridge, Mass. Landscape Architecture Research Office.
THE INTERACTION BETWEEN URBANIZATION AND LAND: QUALITY AND QUANTITY IN ENVIRONMENTAL PLANNING AND DESIGN, THE COMMERCIAL MODEL
Karl Held, Hugh Wilkins, and H. James Brown Jan. 1979 45 p refs
(Grant NSF ENV-72-03372)
(PB-294565/7; NSF/RA-780420) Avail: NTIS HC A03/MF A01 CSCL 13B

The commercial allocation model simulates the location of new commercial facilities. The increased demand for commercial activities results from increased residential population and increased family income within the suburban region. The allocation procedure represents a developer's perspective in estimating the location and size of commercial centers which would be most profitable to build and operate. The allocation is based on estimates of return on investment to a commercial developer as derived through a comparison of the spatial demand for commercial expenditure and the supply of existing shopping facilities. A gravity model is used to generate a surface of retail expenditure potential. GRA

N79-30855# Wisconsin Univ. - Madison. Water Resources Center.
ASSESSMENT OF A COOLING LAKE ECOSYSTEM
Stephen J. Lozano, Dennis W. Randorf, and James F. Kitchell 1978 120 p refs
(Contracts DI-14-34-0001-6052; DI-14-34-0001-7105)
(PB-294537/6; WIS/WRC-78/08; W79-05964; OWRT-A-070-WIS(3)) Avail: NTIS HC A06/MF A01 CSCL 13B

Primary production, aquatic invertebrates, and fish were studied during 1975-1977 to determine responses of organisms to a 15 C temperature gradient in a 190-hectare diked cooling lake, Lake Columbia, WI. The relative importance of macrophytes, periphyton, and phytoplankton production to primary production of the cooling lake is discussed. Seasonal and spatial changes in species composition of periphyton are shown. Field and laboratory studies of invertebrate distribution, growth, and reproduction show evidence that modified life history and temperature directed movement are two important mechanisms by which invertebrates change their distribution in a heterothermal environment. Species diversity, distribution, growth, and reproductive responses of fish in a newly impounded cooling lake are described. Simple models are used to describe relative abundance and aggregation of fish relative to water temperature during summer and winter. The importance of temperature changes, caused by spring power plant shutdowns is described. GRA

N79-30856# SRI International Corp., Menlo Park, Calif.
MODELING OF STATIONARY AIR POLLUTION SOURCES

IN THE CENTRAL AND WESTERN KERN COUNTY OIL FIELDS. TASK REPORT. VOLUME 2: APPENDICES
Patricia B. Simmon Jan. 1979 78 p
(Contract EPA-68-01-4137)
(PB-294813/1; SRI-5258-7-Vol-2) Avail: NTIS HC A05/MF A01 CSCL 13B

Sulfur dioxide pollution from steam-injection oil recovery and from other sources in Kern County, California, was studied with a mathematical model. This volume consists of tables of data and of a list of modifications made to the CDM program. GRA

N79-30857# National Technical Information Service, Springfield, Va.
POLLUTION AND ENVIRONMENTAL ASPECTS OF FUEL CONVERSION. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Mar. 1979
Audrey S. Hundemann May 1979 278 p Supersedes NTIS/PS-78/0314, NTIS/PS-77/0212, NTIS/PS-76/0222 and NTIS/PS-75/371
(NTIS/PS-79/0378; NTIS/PS-78/0314; NTIS/PS-77/0212; NTIS/PS-76/0222; NTIS/PS-75/371) Avail: NTIS HC $28.00/MF $28.00 CSCL 07A

Abstracts dealing with environmental impacts related to fossil fuel conversion processes (primarily coal gasification) are presented. A few citations concerning environmental considerations pertaining to future energy growth are included. GRA

N79-30858# Harvard Univ., Cambridge, Mass. Landscape Architecture Research Office.
THE INTERACTION BETWEEN URBANIZATION AND LAND: QUALITY AND QUANTITY IN ENVIRONMENTAL PLANNING AND DESIGN. THE PUBLIC FISCAL ACCOUNTING MODEL
John Kirlin and H. James Brown Jan. 1979 56 p refs
(Grant NSF ENV-72-03372)
(PB-294620/0; NSF/RA-780435) Avail: NTIS HC A04/MF A01 CSCL 05A

The public fiscal accounting model estimates the required municipal property tax rate needed to balance a town's budget at the end of a five-year development period. The model is designed to handle several successive five-year allocation periods. The accounting model receives estimates of annual operating expenditures from the public expenditures model. The output from the model includes descriptions of expenditures, revenues, tax base, and tax rates. GRA

N79-30859# Hitchcock Associates, Farmington, Conn.
A PROBLEM WITH FLUX CHAMBER MEASUREMENTS OF BIOGENIC SULFUR EMISSIONS Final Report, Jul. - Oct. 1978
Dian R. Hitchcock Apr. 1979 29 p refs
(PB-294734/9; EPA-600/3-79-033) Avail: NTIS HC A03/MF A01 CSCL 04A

Problems associated with identifying and quantifying factors that influence liquid-phase controlled evolution of hydrogen sulfide and organic sulfides through the air-water interface are briefly reviewed. It was found that at present flux chamber measurements of the releases of these biogenic substances from natural systems cannot be regarded as reliable estimates of releases occurring when the system is not enclosed by a chamber. GRA

N79-30860# Worldwatch Inst., Washington, D. C.
THE GLOBAL ENVIRONMENT AND BASIC HUMAN NEEDS
1978 60 p refs Sponsored by Council on Environmental Quality
(PB-295259/6) Avail: NTIS HC A04/MF A01 CSCL 13B

Global dimensions of environmental issues and problems facing the worlds today are addressed. Issues and problems covered include productivity; environment and health; endangered species and endangered habitats; energy and the environment; climate change; the ozone layer; and population, equity, and the environment. GRA

N79-30861# Environmental Protection Agency, Washington, D. C. Div. of Stationary Source Enforcement.
COMPLIANCE STATUS OF MAJOR AIR POLLUTION FACILITIES Final Report
Nov. 1978 769 p
(PB-294953/5; EPA-340/1-78-012) Avail: NTIS HC A99/MF A01 CSCL 13B

This is the seventh in a series of periodic reports presenting the probable compliance status and related facility information for major stationary sources of air pollution. The contents of this report were generated from the U.S. Environmental Protection Agency's Compliance Data System and lists those facilities of interest to the States or the Agency for further investigation. GRA

N79-30862# International Ozone Association, Orlando, Fla.
RECENT DEVELOPMENT IN THE ROLE OF OZONE IN WATER PURIFICATION AND ITS IMPLICATIONS IN DEVELOPING COUNTRIES
B. Z. Diamant 1978 25 p refs Presented at the 2d Workshop on Marine and Freshwater Ozone Appl., Orlando, Fla., 1-3 Nov. 1978 Sponsored in part by Agency for Intern. Develop., Washington, D. C.
(PB-294705/9) Avail: NTIS HC A02/MF A01 CSCL 13B

The recent discoveries of halo-organic carcinogens in water supplies highlighted the long existing, most suitable replacement to the hazardous chlorine; the gas ozone. The development of ozone in water purifications as it relates to the developing countries is discussed. A reference list is included. GRA

N79-30863# Center for Environmental Reporting, Washington, D. C.
ENVIRONMENTAL STATISTICS, 1978
Mar. 1979 264 p Prepared in cooperation with Sigma Data Computing Corp., Rockville, Md. Sponsored in part by Geol. Surv., Reston, Va. and EPA, Washington, D. C.
(Contracts EQ8AC004; EQ7AC003)
(PB-294141/7) Avail: NTIS HC A12/MF A01 CSCL 13B

Environmental Statistics 1978 is a book of tables. They contain environmental data, primarily in time series form, chosen to provide an accurate record of important and recent trends in the environment. The publication contains approximately 200 tables organized into twelve chapters dealing with land and land-based activities (population growth and distribution, land use, wetlands, wilderness, parks, historic sites, risk zones, human settlements, transportation, industrial production, solid waste, hazardous substances, cropland, forests, grazing land, wildlife, and energy), water (water resources and water quality), and air (air quality). Environmental Statistics 1978 is not comprehensive in coverage nor do the tables include sufficient detail for regional and local analysis. GRA

N79-30864# Radian Corp., Austin, Tex.
TRACE ELEMENTS OF FLY ASH: EMISSIONS FROM COAL-FIRED STEAM PLANTS EQUIPPED WITH HOT-SIDE AND COLD-SIDE ELECTROSTATIC PRECIPITATORS FOR PARTICULATE CONTROL Final Report
Robert M. Mann, Robert A. Magee, Robert V. Collins, Michael R. Fuchs, and Frank G. Mesich Dec. 1978 163 p refs
(Contract EPA-68-01-3702)
(PB-295040/0; RAD-78-216-137-09; EPA-908/4-78-008) Avail: NTIS HC A08/MF A01 CSCL 07D

The results of a sampling and chemical analysis study of emissions from two coal-fired steam plants equipped with electrostatic precipitators for particulate control are described. Fly ash collected from the stack using cyclones and cascade impactors was analyzed to define trace element concentration of individual size fractions. Trace element enrichment of ash fractions was compared with an enrichment model to define the dependence of enrichment on particle size. Samples of the feed coal at each station were subjected to density separation to determine the association of each element with mineral (ash) and organic (ash-free) phases of the coal. GRA

N79-30865# Utah Water Research Lab., Logan.
STOCHASTIC ANALYSIS OF WATER QUALITY
Ronald F. Malone, David S. Bowles, William J. Grenney, and Michael P. Windham Mar. 1979 79 p refs
(Contract DI-14-34-0001-8047; OWRT Proj. A-039-UTAH(2))
(PB-295392/5; UWRL-Q-79/01; W79-06501) Avail: NTIS HC A05/MF A01 CSCL 13B

The feasibility of applying stochastic techniques to linear

water quality models was studied. The Monte Carlo, First Order, and Generation of Moment Equation techniques are applied to a long term phosphorus model of Lake Washington. The effect of uncertainty of the phosphorus loading term on simulated phosphorus levels is analyzed. All three stochastic techniques produced the same results. The simulated concentrations of phosphorus in the water column are very responsive to uncertainty in annual phosphorus loading, the sediment concentrations relatively insensitive. The Monte Carlo technique requires the most computation time of the three stochastic techniques applied. The Generation of Moment Equations technique is also applied to a steady state salinity model of the Colorado River system. The major source of uncertainty in all simulations is the estimation of the steady state salinity loading with the agricultural loading term becoming important in some simulated management alternatives. GRA

N79-30866# North Carolina State Univ. at Raleigh. Dept. of Chemical Engineering.
POLYMERIC INTERFACES FOR STACK MONITORING Final Report, Jan. 1973 - Jun. 1976
Richard M. Felder and James K. Ferrell Nov. 1978 187 p refs
(Grant EPA-R-801578)
(PB-294997/2; EPA-600/2-78-214) Avail: NTIS HC A09/MF A01 CSCL 14B

Research has been performed on the use of polymeric interfaces for in situ continuous stack monitoring of gaseous pollutants. Permeabilities of candidate interface materials to SO2 were measured at temperatures from ambient to 200 C, and the results were used to design interfaces for field tests. A portable field monitoring system was constructed and used to carry out SO2 monitoring runs in two SO3 absorption tower stacks, and in oil-fired and coal-fired power plant boiler stacks. The results were in agreement with data obtained by standard wet chemical methods. GRA

N79-30867# Florida State Univ., Tallahassee. Dept. of Oceanography.
SOURCES AND TRANSPORT OF TRACE METALS IN URBAN AEROSOLS Final Report, Apr. 1973 - Jan. 1976
John W. Winchester and J. William Nelson Mar. 1979 77 p refs
(Grant EPA-R-802132)
(PB-294838/8; EPA-600/3-79-019) Avail: NTIS HC A05/MF A01 CSCL 07D

A methodology was developed, tested, and applied to the identification of trace elements aerosol sources and trace element aerosol transport phenomena. The method uses light weight and portable field sampling equipment, and results in the acquisition of large data sets suitable for statistical analysis and the testing of aerosol transport models. Aerosol sampling in the ambient atmosphere was accomplished through a combination of time-sequences filter collections with hourly resolution, and fractionated aerosol collections. Elemental analysis was performed with particle induced X-ray emission, a sensitive and rapid method. Aerosol characterization studies were focussed on St. Louis, Missouri, during the Regional Air Pollution Study. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N79-30868*# Analytic Sciences Corp., Reading, Mass.
ESTIMATION OF THE OCEAN GEOID NEAR THE BLAKE ESCARPMENT USING GEOS-3 SATELLITE ALTIMETRY
Robert F. Brammer Aug. 1979 34 p refs
(Contract NAS6-2476)
(NASA-CR-156857) Avail: NTIS HC A03/MF A01 CSCL 08G

The accuracy with which the local ocean geoid structure could be determined using satellite altimetry data was investigated. The undulation and along-track component of the vertical deflection for selected passes of GEOS-3 near the Blake Escarpment were estimated and compared with independent analogous estimates based on U. S. Navy surface gravimetric survey data. The results of these comparisons show agreement in the geoid undulation values generally to within one or two meters. The nature of the discrepancy in the undulation values was primarily that of a bias error believed to be due essentially to radial orbit uncertainties. The agreement between the vertical deflection estimates was not significantly affected by orbit uncertainties over the track lengths considered in this study (100 - 1500 km), and the comparisons show typical rms differences of between one and two arc secs. In addition, the capability of the altimeter to resolve short wavelength features of the geoid was determined. This analysis involved spectrum and cross spectrum analysis of sets of closely spaced parallel subtracks to determine statistically significant short wavelength geoid resolution capability. The results of this analysis show that resolution can be achieved down to wavelengths as short as 30 km - 80 km depending on regional geoid variations. K.L.

N79-30869*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PROCEEDINGS: WORKSHOP ON THE NEED FOR LIGHTNING OBSERVATIONS FROM SPACE
Larry S. Christensen, ed., Walter Frost, ed., and William W. Vaughan, ed. Jul. 1979 255 p refs Workshop held at Tullahoma, Tenn., 13-15 Feb. 1979 Supersedes NASA-CP-2083; N79-21697 Prepared in cooperation with Tenn. Univ. Space Inst., Tullahoma
(NASA-CP-2095) Avail: NTIS HC A12/MF A01 CSCL 04A

The results of the Workshop on the Need for Lightning Observations from Space held February 13-15, 1979, at the University of Tennessee Space Institute, Tullahoma, Tennessee are presented. The interest and active involvement by the engineering, operational, and scientific participants in the workshop demonstrated that lightning observations from space is a goal well worth pursuing. The unique contributions, measurement requirements, and supportive research investigations were defined for a number of important applications. Lightning has a significant role in atmospheric processes and needs to be systematically investigated. Satellite instrumentation specifically designed for indicating the characteristics of lightning are of value in severe storms research, in engineering and operational problem areas, and in providing information on atmospheric electricity and its role in meteorological processes. For individual titles, see N79-30870 through N79-30879.

N79-30870*# New Mexico Inst. of Mining and Technology, Socorro.
LIGHTNING PROPERTIES AND ASSOCIATED EMISSIONS
Marx Brook *In* NASA. Marshall Space Flight Center Proc.: Workshop on the Need for Lightning Observations from Space Jul. 1979 p 25-60 refs (For primary document see N79-30869 21-46)
Avail: NTIS HC A12/MF A01 CSCL 04A

A brief overview of the lightning observables and environment is provided. A selective review is presented of those properties of lightning which might be useful as space observables. G.Y.

N79-30871*# Air Force Academy, Colo.
A REVIEW OF SATELLITE LIGHTNING EXPERIMENTS
Bobby N. Turman *In* NASA. Marshall Space Flight Center Proc.: Workshop on the Need for Lightning Observations from Space Jul. 1979 p 61-80 refs (For primary document see N79-30869 21-46)
Avail: NTIS HC A12/MF A01 CSCL 04A

Over the past five years a series of satellite optical experiments were conducted to investigate terrestrial lightning. These experiments were designed to gather statistical information about the optical waveform of lightning, measure occurrence rates, demonstrate the feasibility of detecting lightning from space platforms, and study possible applications for satellite lightning sensors. These experiments are reviewed. Some of the results are presented, and some ideas for future satellite systems are discussed. G.Y.

N79-30872*# Aerospace Corp., Los Angeles, Calif.
STATE OF TECHNOLOGY IN OPTICAL SYSTEMS

Bruce C. Edgar *In* NASA. Marshall Space Flight Center Proc.: Workshop on the Need for Lightning Observations from Space Jul. 1979 p 81-87 refs (For primary document see N79-30869 21-46)
Avail: NTIS HC A12/MF A01 CSCL 04A

The use of silicon photodiode sensors and locator systems for lightning experiments is discussed. Tables are presented on: (1) satellite optical lightning experiments (silicon detectors); (2) reticon photodiode linear arrays; and (3) locator systems (grey code and reticon). An illustration of a grey code locator system for a low altitude satellite is also given. G.Y.

N79-30873*# Auburn Univ., Ala.
THE STATE OF TECHNOLOGY IN ELECTROMAGNETIC (RF) SENSORS (FOR LIGHTNING DETECTION)
Thomas H. Shumpert and Martial A. Honnell *In* NASA. Marshall Space Flight Center Proc.: Workshop on the Need for Lightning Observations from Space Jul. 1979 p 88-109 refs (For primary document see N79-30869 21-46)
Avail: NTIS HC A12/MF A01 CSCL 04A

A brief overview of the radio-frequency sensors which were applied to the detection, isolation, and/or identification of the transient electromagnetic energy (sferics) radiated from one or more lightning discharges in the atmosphere is presented. Radio frequency (RF) characteristics of lightning discharges, general RF sensor (antenna) characteristics, sensors and systems previously used for sferic detection, electromagnetic pulse sensors are discussed. References containing extensive bibliographies concerning lightning are presented. G.Y.

N79-30874*# Bureau of Land Management, Denver, Colo.
THE GEOGRAPHICAL DISTRIBUTION OF LIGHTNING: FORESTRY AND RANGE REQUIREMENTS AND INTERESTS
Dale L. Vance *In* NASA. Marshall Space Flight Center Proc.: Workshop on the Need for Lightning Observations from Space Jul. 1979 p 110-114 refs (For primary document see N79-30869 21-46)
Avail: NTIS HC A12/MF A01 CSCL 04A

In an attempt to reduce the response time of the initial attack forces to lightning-caused fire, a lightning detection system that effectively locates accurate directions to lightning discharges to over 200 miles from the detection equipment was developed. The system was first tested in Alaska in 1975. Since that time, further development and operational testing led to the implementation of wide area networks. For the 1979 fire season an eight station network in Alaska is to be implemented that will cover virtually all of the lightning-caused fire areas in the state. In the western United States, an eighteen station network that will cover approximately 85% of eleven states is to be implemented. For the first time, large scale ground discharge lightning distribution information is to be available. G.Y.

N79-30875*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE COMMUNICATIONS INDUSTRY'S REQUIREMENTS AND INTERESTS
Oley Wanaselja *In its* Proc.: Workshop on the Need for Lightning Observations from Space Jul. 1979 p 115-125 (For primary document see N79-30869 21-46)
Avail: NTIS HC A12/MF A01 CSCL 04A

Of interest to the communications industry are the amplitude, waveshape, duration and frequency of lightning-originated voltage surges and transients on the communications network, including the distribution system and AC power supply circuits. The cloud-to-ground lightning discharge and its characteristics are thought to be most meaningful. Of specific interest are peak current, waveshape, number of flashes, strokes per flash, and zone of influence. Accurate and meaningful lightning data at the local level (telephone district office) is necessary for a decision on the appropriate protection level. In addition to lightning, the protection engineer must consider other factors such as: AC induction, switching surges, ground potential rise, soil resistivity, bonding and grounding techniques, shielding and isolation, and exposure of the telephone loop. A.R.H.

N79-30876*# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
LIGHTNING HAZARDS OVERVIEW: AVIATION REQUIREMENTS AND INTERESTS
Phillip B. Corn *In* NASA. Marshall Space Flight Center Proc.: Workshop on the Need for Lightning Observations from Space Jul. 1979 p 126-135 refs (For primary document see N79-30869 21-46)
Avail: NTIS HC A12/MF A01 CSCL 04A

A ten-year history of USAF lightning incidents is presented along with a discussion of the problems posed by lightning to current aircraft, and the hazards it constitutes to the electrical and electronic subsystems of new technology aircraft. Lightning technical protection technical needs, both engineering and operational, include: (1) in-flight data on lightning electrical parameters; (2) tech base and guidelines for protection of advanced systems and structures; (3) improved laboratory test techniques; (4) analysis techniques for predicting induced effects; (5) lightning strike incident data from general aviation; (6) lightning detection systems; (7) pilot reports on lightning strikes; and (8) better training in lightning awareness. A.R.H.

N79-30877*# Colutron Research Corp., Berthoud, Colo.
THE ATMOSPHERIC ELECTRIC GLOBAL CIRCUIT
Heinz W. Kasemir *In* NASA. Marshall Space Flight Center Proc.: Workshop on the Need for Lightning Observations from Space Jul. 1979 p 136-147 refs (For primary document see N79-30869 21-46)
Avail: NTIS HC A12/MF A01 CSCL 04A

The hypothesis that world thunderstorm activity represents the generator for the atmospheric electric current flow in the earth atmosphere between ground and the ionosphere is based on a close correlation between the magnitude and the diurnal variation of the supply current (thunderstorm generator current) and the load current (fair weather air-earth current density integrated over the earth surface). The advantages of using lightning survey satellites to furnish a base for accepting or rejecting the thunderstorm generator hypothesis are discussed. A.R.H.

N79-30878*# National Aeronautics and Space Administration, Washington, D. C.
LIGHTNING AS AN INDICATION OF STORM SEVERITY
James C. Dodge *In* NASA. Marshall Space Flight Center Proc.: Workshop on the Need for Lightning Observations from Space Jul. 1979 p 153-155 refs (For primary document see N79-30869 21-46)
Avail: NTIS HC A12/MF A01 CSCL 04A

There is a substantial case for the theory that cloud electrification is related primarily to strong convection and the sizeable relative air motion that it implies; therefore, the electrification and subsequent discharge rates can be related to the air motion environment of thunderstorms. The isoceraunic contour map used by the WMO for observing and measuring thunderstorm occurrence contains no information on flash rates, flash density, flash relationship to storm severity, or flash variation with meteorological environment. A constant-view geosynchronous lightning mapper would permit simultaneous studies of the lightning discharge patterns and the meteorological environment of storms, thus establishing whether or not there is a reliable enough relationship to use the observed flash rates and characteristics as supplemental guidance for storm forecast refinement. A.R.H.

N79-30879*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PLATFORMS IN SPACE: EVOLUTIONARY TRENDS c12
John M. Butler, Jr. *In its* Proc.: Workshop on the Need for Lightning Observations from Space Jul. 1979 p 159-182 (For primary document see N79-30869 21-46)
Avail: NTIS HC A12/MF A01 CSCL 22A

The problem of physical crowding and the proliferation of separate communication links and ground support systems for multiple free-flying satellites can be overcome by using space platforms and multiplexing the data streams. Pertinent features of the space shuttle orbiter payloads, the solar power satellite, and geostationary and geosynchronous platforms are discussed. Typical payload requirements data which are needed to allow meaningful study of payloads as candidates for platform

implementation are cited and factors affecting the compatibility/grouping of payloads are outlined. A.R.H.

N79-30880# Lamont-Doherty Geological Observatory, Palisades, N. Y.
MULTIPLE SURFACE SCATTERING FROM THE ICE COVERED ARCTIC OCEAN
A. Beilis, F. D. Tappert, and H. W. Kutschale Mar. 1979 53 p refs Prepared in cooperation with New York Univ., N. Y.
(Contract N00014-75-C-0595)
(AD-A069843; LDGO-CU-2-79; TR-2) Avail: NTIS HC A04/MF A01 CSCL 20/1

The range dependent boundary condition imposed by a rough ice surface serves to couple the normal-modes of an underwater acoustic field. Beginning with the parabolic wave equation, the solution is expanded in terms of normal-mode depth functions modulated by random amplitudes. A system of master equations for the quantities < an (r) an > (r) is derived, where the a sub n (r) are the normal mode amplitudes, and the brackets indicate an ensemble average. The master equations determine the mean power in each mode as a function of range, describing the transfer of energy between modes. Explicit relations for the coupling coefficients are obtained in terms of the spectrum of the rough surface. Transmission loss, intensity redistribution and the approach to equipartition of energy as functions of range and depth are obtained numerically. GRA

N79-30881# Air Force Geophysics Lab., Hanscom AFB, Mass.
SHORT DURATION SPORADIC E AND DISCRETE AURORAL EVENTS Final Report
A. Pauline Krukonis, James A. Whalen, and Alfred E. Reilly 4 Jan. 1979 24 p refs
(AF Proj. 4643)
(AD-A069800; AFGL-TR-79-0004; AFGL-ERP-649) Avail: NTIS HC A02/MF A01 CSCL 04/1

The relationship that exists between the occurrence of sporadic E and the incidence of visual aurora is utilized as the basis for the determination of the lifetimes of discrete auroral events in the range of = or > 15 minutes from measurements of durations of sporadic E ionization. Intercomparisons of optical and ionosonde data from aircraft and ground-based installations are presented. GRA

N79-30882# California Univ., Berkeley. Space Sciences Lab.
A STUDY TO RELATE INTERPLANETARY MAGNETIC FIELD PARAMETERS TO AURORAL OVAL PHENOMENA Final Report, 15 Mar. 1976 - 30 Sep. 1978
Ching-I. Meng and Kinsey A. Anderson Hanscom AFB, Mass. AFGL Dec. 1978 66 p refs
(Contract F19628-76-C-0125; AF Proj. 7663)
(AD-A069724; SSL-Ser-20-Issue-1; AFGL-TR-79-0022) Avail: NTIS HC A04/MF A01 CSCL 04/1

The first part of this report summarizes the major results of a study of auroral oval phenomena and interplanetary magnetic field. The second part presents an up-dated understanding on the auroral oval phenomena and their relation with the interplanetary magnetic field. It reviews research involved with direct and inferred determinations of the polar cap size and location, as well as their relationships with the interplanetary magnetic field. First, the progress in the observation and understanding of polar cap size variations as related to changes of the interplanetary magnetic field magnitude and direction is reported. Obtained by scaling the global auroral distributions from DMSP auroral pictures, some new results on configurational changes of the auroral oval (i.e., the polar cap) with different orientations of the interplanetary magnetic field are also discussed. There are indications of the dawn-dusk and sunward-tailward displacements of the auroral oval in association with the interplanetary magnetic field B sub y and B sub x components, respectively. It is obvious from this review that a better understanding of the interaction between the terrestrial magnetosphere and the interplanetary magnetic field requires further efforts, both observational and theoretical. GRA

N79-30883# Nevada Univ., Reno. Seismological Lab.
SURFACE WAVES, SEISMIC REFRACTION AND UPPER MANTLE OF THE BASIN AND RANGE Semiannual Technical Report, 1 Feb. 1977 - 30 Sep. 1978
Keith F. Priestley 3 Apr. 1979 75 p ' refs
(Contract F49620-77-C-0070; ARPA Order 3291)
(AD-A070053; AFOSR-79-0685TR; SATR-3) Avail: NTIS HC A04/MF A01 CSCL 08/7

Body wave travel-times, surface wave dispersion, and gravity data have been used to refine the structural details of the crust and upper mantle within the northern Basin and Range. The crust varies in thickness from 35-40 km SE of Rend to 28 km in the western Battle Mountain heat flow high and 45-50 km in central Oregon. The mantle lid structure derived from fundamental mode surface wave data has been confirmed by higher mode surface wave data. Fundamental and higher mode dispersion data for southern Nevada and Arizona indicate the structure of the southern Basin and Range is similar to that of the Great Basin. GRA

N79-30884# Liege Univ. (Belgium). Inst. d'Astrophysique.
HIGH RESOLUTION TRANSMISSION MEASUREMENTS OF THE ATMOSPHERE IN THE INFRARED Final Report, 1 Mar. 1976 - 28 Feb. 1979
M. Migeotte, R. Zander, and L. Delbouille 27 Apr. 1979 43 p refs
(Grant AF-AFOSR-2985-76)
(AD-A070182; AFGL-TR-79-0119) Avail: NTIS HC A03/MF A01 CSCL 04/1

Measurements have been made of solar spectra from the International Scientific Station of the Jungfraujoch and supplements have been added to the Photometric Atlas of the Solar Spectrum from 3000-10,000 Angstroms. The spectral domain covered by the Atlas now extends from 4,006-7,994 Angstroms. In addition to the extension of the solar atlas, measurements made near 2.5 and 3.3 micrometers have been used for deducing trace atmospheric species such as hydrofluoric and hydrochloric acid. A Fourier transform spectrometer has been used to record high accuracy solar spectra in the atmospheric windows between 1.1 and 2.5 micrometers. Stratospheric balloon instrumentation has been flown on two occasions to obtain solar spectra in selected intervals between 1.8 and 8.1 micrometers. The object here is to measure trace atmospheric species in spectral regions of significant atmospheric absorption by other species. GRA

N79-30885# Los Alamos Scientific Lab., N. Mex.
PREDICTION OF HIGH ENERGY (GREATER THAN 0.3 MeV) SUBSTORM-RELATED MAGNETOSPHERIC PARTICLES
D. N. Baker, R. D. Belian, P. R. Higbie, and E. W. Hones, Jr. 1979 12 p refs Presented at Intern. Solar-Terrestrial Predictions Workshop, Boulder, Colo., 23-27 Apr. 1979
(Contract W-7405-eng-36)
(LA-UR-78-3050; Conf-790413-2) Avail: NTIS HC A02/MF A01

Measurements both at 6.6 R/sub E/ and in the plasma sheet (greater than or equal to 18 R/sub E/) show that high energy substorm-accelerated particles occur preferentially when the solar wind speed is high. Virtually no greater than 0.3 MeV protons, for example, are observed in association with substorms that occur when V/sub sw/ is less than 400 km/sec. On the other hand, the probability of observing high energy protons is very large, both at geostationary orbit and in the plasma sheet, when V/sub sw/is greater than 700 km/sec. These results suggest that realtime monitoring of interplanetary conditions could allow simple, effective prediction of high energy magnetospheric particle disturbances. DOE

N79-30886# California Univ., Livermore. Lawrence Livermore Lab.
GRAVITY INVERSION CODE
Norman R. Burkhard 1 Feb. 1979 24 p refs
(Contract W-7405-eng-48)
(UCID-18043) Avail: NTIS HC A04/MF A01

The gravity inversion code applies stabilized linear inverse theory to determine the topography of a subsurface density anomaly from Bouguer gravity data. The gravity inversion program consists of four source codes; SEARCH, TREND, INVERT, and AVERAGE. The TREND and INVERT codes are used iteratively to converge on a solution. The SEARCH code forms the input gravity data files and AVERAGE performs a covariance analysis on the solution. The necessary input files and the proper operation of the code are described. DOE

N79-30887# Sandia Labs., Albuquerque, N. Mex. Experiments Planning Div.
SONIC VELOCITY AS A FUNCTION OF DEPTH IN ALLUVIUM
Robert C. Bass Dec. 1978 18 p refs
(Contract EY-76-C-04-0789)
(SAND-78-0547) Avail: NTIS HC A02/MF A01

Sonic velocity in a porous desert alluvial soil was measured in situ as a function of depth below the surface. Values obtained range from 0.595 kilometers per second at a depth of 152 meters to 0.868 kilometers per second at depths of 366 meters. The observed variation of sonic velocity with depth may be explained by a medium in which the water content decreased linearly with distance away from the water table. DOE

N79-30888# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Optoelektronik.
ATMOSPHERIC RAYLEIGH SCATTERING IN THE ULTRAVIOLET AND VISIBLE SPECTRA
Dieter Beran Oct. 1978 48 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-588)
(DLR-Mitt-78-03) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 17,90

Attenuation by scattering and absorption of solar radiation entering the earth's atmosphere was studied in order to determine the role of Rayleigh scattering in this phenomenon. Rayleigh scattering is a function of the solar flux and of the scattering cross section both of which depend on the wavelength. Thus, Rayleigh intensity is also a function of wavelength. Generally, Rayleigh scattering is single scattering because the small cross section and with it, the low optical depth, do not permit multiple scattering. Rayleigh intensity however depends on direction and is polarized. For the anistropic air molecules a depolarization factor must be involved. It is concluded that the absorption of solar radiation in the wavelength region under consideration is caused mainly by ozone and by molecular oxygen. Author (ESA)

N79-30889# National Oceanic and Atmospheric Administration, Silver Spring, Md. Air Resources Lab.
URBAN-RURAL SOLAR RADIATION MEASUREMENTS IN ST. LOUIS, MISSOURI
James T. Peterson (Geophysical Monitoring for Climatic Change, Boulder, Colo.) and Thomas L. Toffel (Geophysical Monitoring for Climatic Change, Boulder, Colo.) Mar. 1979 56 p refs
(E(49-26)-1041)
(PB-295591/2; NOAA-TM-ERL-ARL-76; NOAA-79032802) Avail: NTIS HC A04/MF A01 CSCL 04A

The simultaneous measurements of incident solar radiation from six locations in metropolitan St. Louis, Mo., are analyzed. The urban-rural variations of incident solar radiation in this area are presented. Comparisons were stratified according to wind direction, speed, visibility, time of day, and day week. The effects of air pollution, atmospheric attenuation, and cloud cover on solar radiation are examined. GRA

N79-30890# Transportation Research Board, Washington, D. C.
MOISTURE AND FROST-RELATED SOIL PROPERTIES
Amir N. Hanna, Bernard D. Alkire, Allen R. Tice, Chester M. Burrous, and Duwayne M. Anderson 1978 51 p refs
(PB-295105/1; TRB/TRR-675) Avail: NTIS HC A04/MF A01 CSCL 08M

The 7 papers presented deal with the following areas: expanded polystyrene concrete subbases; some factors that affect thaw strain; phase composition measurements on soils at very high water contents by the pulsed nuclear magnetic resonance technique; evaluation of hysteresis in mercury intrusion porosimetry by second-intrusion method; effects of water adsorption on kaolin clay during shear; effect of drying temperature on the index properties of calcretes; and laboratory evaluation of materials and design characteristics of penndot underdrain system. GRA

N79-30265*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Radio Frequency and Microwave Subsystems Section.
X-BAND ATMOSPHERIC NOISE TEMPERATURE DATA AND STATISTICS AT GOLDSTONE, DSS 13, 1977 - 1978
S. D. Slobin, K. B. Wallace, M. M. Franco, E. M. Andres, and O. V. Hester *In its* The Deep Space Network 15 Aug. 1979 p 108-116 refs (For primary document see N79-30248 21-12) Avail: NTIS HC A06/MF A01 CSCL 04A

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N79-30891 British Library Lending Div., Boston Spa (England).
CORRELATING THE MAXIMUM AND MINIMUM TEMPERATURES WITH SOLAR ACTIVITY AND OTHER WEATHER VARIABLES
K. Mares and I. Mares 27 Mar. 1979 16 p refs Transl. into ENGLISH from Meteorol. and Hydrol. (Bucharest), no. 1, 1976 p 39-46 In ENGLISH and RUSSIAN
(BLL-Trans-1365-(9022.549)) Avail: British Library Lending Div., Boston Spa, Engl.

The correlations between some meteorological elements as well as between these elements and solar activity were studied. The following elements were considered: atmospheric pressure, maximum and minimum temperature, mean daily temperature, vapor pressure, relative humidity, amount of precipitation, daily sunshine duration, mean daily wind speed, and mean daily cloud amount. M.M.M.

N79-30892 Freie Univ., Berlin (West Germany).
METEOROLOGICAL DATA, SERIES A MONOGRAPHS. VOLUME 2, NO. 1: A STUDY OF THE STRATOSPHERE CLIMATOLOGY IN THE SOUTHERN HEMISPHERE [METEOROLOGISCHE ABHANDLUNGEN, SERIE A MONOGRAPHIEN. BAND 2, HEFT 1. EIN BEITRAGZUR KLIMATOLOGIE DER STRATOSPHAERE DER SUEDHALBKUGEL]
Juergen Knittel Verlag von Dietrich Reimer 1976 299 p refs In GERMAN; ENGLISH summary Sponsored by Deut. Forschungsgemeinschaft
Copyright. Avail: Issuing Activity

The circulation of the stratosphere of the Southern Hemisphere is described for the 100 mb, 50 mb, and 30 mb levels. The description is based on five-yearly means, derived from radiosonde measurements. The mean conditions of the geopotential heights, temperatures, and winds are examined. Changes from month to month are discussed and the two hemispheres are compared. To examine the differences between single years, the standard deviations were calculated and are shown for selected months. The monthly mean maps of the geopotential heights and the temperatures of the three levels are shown. Additionally, tables with grid point values of geopotential heights, temperatures, and geostrophic wind components u, v and the resultant geostrophic winds are included. The yearly and half-yearly waves of the geopotential heights and the temperatures are discussed in detail and comparisons are made with the same waves of the Northern Hemisphere. The planetary waves of the Southern Hemisphere are described likewise, and they are compared with these of the Northern Hemisphere. Author (ESA)

N79-30893# National Environmental Satellite Service, Washington, D. C.
ERROR CHARACTERISTICS OF SATELLITE-DERIVED WINDS
Lester F. Hubert and Albert Thomasell, Jr. Jun. 1979 40 p refs
(NOAA-TR-NESS-79; NOAA-S/T-79-152) Avail: NTIS HC A03/MF A01

Errors of winds derived from geostationary satellite measurements are estimated by analysis of differences between satellite and rawin observations. The errors stem from the noise inherent in measuring cloud displacements and errors introduced by meteorological influences. System noise, evaluated by three independent techniques, amounts to rms vector magnitudes of 2.5 to 3.0 m/s for picture pair vectors and about 4 m/s for manual vectors. These figures pertain only to clouds tracked with infrared imagery. The accuracy of these data can be increased by reducing system noise, but improving their meteorological

value can be realized only by modifying procedures to enable clouds to be tracked in meteorologically active regions. M.M.M.

N79-30894# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 12828D LANCE, MISSILE NUMBER 4347, ROUND NUMBER 326ESL
Mar. 1979 42 p
(DA Proj. 1T6-65702-D-127)
(AD-A070488; ECOM-DR-989) Avail: NTIS HC A03/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 12828d Lance, Missile number 4347, Round number 326 ESL are presented in tabular form. Author (GRA)

N79-30895# Bohan (Walter A.) Co., Park Ridge, Ill.
NAVY TACTICAL APPLICATIONS GUIDE. VOLUME 2: ENVIRONMENTAL PHENOMENA AND EFFECTS
Robert W. Frett, Paul E. LaViolette, Martin Nestor, Jerry W. Nickerson, and Kevin Rabe Jan. 1979 219 p refs
(Contract N00228-76-C-3025; ZF52551001)
(AD-A070305; NEPRF-TR-77-04) Avail: NTIS HC A10/MF A01 CSCL 04/2

Large- and local-scale atmospheric phenomena and effects, detected in DMSP visible and infrared imagery, are illustrated and correlated with conventional surface and upper-air data. Oceanographic phenomena are similarly described and documented. Examples of large-scale atmospheric phenomena are jet streams, cellular cloud patterns, anomalous cloud lines, cloud lines in general, and vortical cloud patterns. Local-scale atmospheric effects include land and sea breezes valley-ridge circulation patterns fog, haze, and atmospheric pollution severe weather and air-sea interaction. The oceanographic section contains examples of oceanic fronts and eddies, upwelling, internal waves, coastal sediment, and sea ice. The examples shown are presented as case studies, following detailed introductions which provide background concerning the pheonomena and their usefulness in determining related parameters for environmental analysis and prediction. Author (GRA)

N79-30896# Weather Wing (1st), Hickam AFB, Hawaii.
A METHODOLOGY TO ANALYZE FORECAST PROBLEMS
Phillip D. Wood 9 Apr. 1979 13 p
(AD-A069687; Rept-1WW-TN-79-2) Avail: NTIS HC A02/MF A01 CSCL 04/2

This report describes a problem analysis methodology recommended for use by base weather station managers whenever an adverse trend in forecast or local point warning performance is observed. GRA

N79-30897# Air Force Geophysics Lab., Hanscom AFB, Mass.
A MARINE BOUNDARY LAYER SAMPLING/FLIGHT IN CLEAR AIR
Donald J. Varley 10 Jan. 1979 90 p refs
(AF Proj. 317J)
(AD-A069723; AFGL-TR-79-0013; AFGL-ERP-652) Avail: NTIS HC A05/MF A01 CSCL 04/2

The AFGL-instrumented MC-130E aircraft made several 8-min particle-sampling passes off the San Francisco coast on 10 July 1978 at levels from 100 to 1000 ft altitude. Spectrometers capable of recording particles from 2 to 6400 micrometers were used, but in the existing cloudless conditions only particles between 2 and 30 micrometers were detected. These were recorded by the PMS axial scattering spectrometer probe. Visibility was estimated at 7 miles with a slight amount of haze during most of the sampling; however, the particle populations varied widely, and the computed liquid water content varied from 0.000001 to 0.01/cu gm while passes were made at the 100 and 200 ft levels. The 300 ft level was relatively particle-deficient, but the particle concentration at 400 ft was similar to those at 100 and 200 ft. Average particle counts decreased significantly between 500 and 1000 ft, as compared to lower levels. GRA

N79-30898# Environmental Research and Technology, Inc., Concord, Mass.
A METHODOLOGY FOR CROSS SECTION ANALYSIS AND LIQUID WATER CONTENT ASSESSMENT AT KWAJALEIN Progress Report, Jan. - Dec. 1977
Allan J. Bussey Jul. 1978 43 p refs
(Contract F19628-76-C-0069; AF Proj. 627A)
(AD-A069725; ERT-P-1996; AFGL-TR-78-0189; SR-2) Avail: NTIS HC A03/MF A01 CSCL 04/2

Analyzing surface and upper air meteorological observations in the form of a time cross section is a concise form of simulating atmospheric conditions over a particular location. Using these observations and DMSP satellite data, procedures for estimating the liquid water content within regions of cloud and precipitation have been derived. The procedures for deriving the liquid water content profiles have evolved over a five-year period, and it is the purpose of this report to describe the current methodology. The profiles of liquid water content are used as input for a determination of the erosion severity index (ESI). The advantage of the techniques described is that estimates or a climatology of ESI can be obtained in any part of the world through an analysis of readily available meteorological observations. GRA

N79-30899# Extranuclear Labs., Pittsburgh, Pa.
STUDIES OF THE BALLOON-BORNE MASS SPECTROMETER PROBLEM Final Report, 1 Jul. 1977 - 30 Aug. 1978
M. W. Siegel and W. L. Fite 30 Aug. 1978 127 p refs
(Contract F19628-77-C-0183; AF Proj. 6687)
(AD-A069726; AFGL-TR-78-0220) Avail: NTIS HC A07/MF A01 CSCL 14/2

The project involved theoretical studies of the ion sampling problem for balloon-borne mass spectrometric apparatus in the stratosphere, manufacturing of standard, special, and prototype apparatus, construction of a vacuum system and ancillary apparatus for testing and experimentation, and described experimental work. Appendices to the report include a literature survey and instructions for the deliverable manufactured items. GRA

N79-30900# National Hurricane Center, Coral Gables, Fla.
ANNUAL DATA AND VERIFICATION TABULATION: ATLANTIC TROPICAL CYCLONES, 1977
Miles B. Lawrence and Paul J. Hebert Mar. 1979 53 p refs
(PB-295702/5; NOAA/TM/NWS/NHC-8; NOAA-79041203)
Avail: NTIS HC A04/MF A01 CSCL 04B

Data on Atlantic tropical cyclones for 1977 is presented. Tracks of 1977 named storms are shown. Verification statistics for the 1977 season are shown in tabular form. A verification statistic included in this year's data tabulation is tropical cyclone warning lead times. Daily GOES-2 satellite photographs of 1977 named tropical cyclones are shown and selected radar photographs of hurricane Anita are included. GRA

N79-30901# National Weather Service, Kansas City, Mo.
WARM SEASON NOCTURNAL QUANTITATIVE PRECIPITATION FORECASTING FOR EASTERN KANSAS USING THE SURFACE GEOSTROPHIC WIND CHART
Wayne E. Sangster Apr. 1979 50 p refs
(PB-295982/3; NOAA-TM-NWS-CR-64; NOAA-79041202)
Avail: NTIS HC A03/MF A01 CSCL 04B

The surface geostrophic wind (SGW) chart has been used to statistically derive probability of precipitation (PoP) and probability of precipitation amount (PoPA) equations for the nighttime periods for eastern Kansas and extreme western Missouri. The season of interest is May through September. These PoP and PoPA values were then compared for skill with Model Output Statistics (MOS) values transmitted from the National Meteorological Center. The SGW values were found to be inferior on independent data to those of MOS in all 5 scores computed, however, a consensus of SGW and MOS was superior to MOS in 3 of 5 scores. GRA

N79-30902# National Oceanic and Atmospheric Administration, Washington, D. C. Environmental Data and Information Service.
MARINERS WEATHER LOG, VOLUME 23, NO. 2
Elwyn E. Wilson Mar. 1979 147 p
(PB-295860/1; NOAA-79042002) Avail: NTIS HC A07/MF A01 CSCL 04B

In addition to its regular sections, this issue contains the following articles: Anatomy of a Storm; North Atlantic tropical cyclones, 1978; and Sudden gale hits Pacific Northwest tuna fleet. GRA

N79-30903# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
MULTIPLE DOPPLER RADAR ANALYSIS SYSTEM (MUDRAS)
Nathan M. Kohn, Andrew L. Johnston, and Carl Mohr Aug. 1978 163 p refs
(PB-295608/4; NOAA-TM-ERL-WPL-35; NOAA-78092702) Avail: NTIS HC A08/MF A01 CSCL 04B

The Multiple Doppler Radar Analysis System (MUDRAS) is a software package consisting of four data formats and nine computer programs which provide analysts a flexible tool for processing and interpreting meteorological data. The data formats are called MUDRAS time series, MUDRAS pulse pair, MUDRAS archive, and MUDRAS cartesian tapes; these are described under tape organization. These programs are implemented on the CDC 6600 and the CDC 7600 and are written principally in FORTRAN. GRA

N79-30904# Army Cold Regions Research and Engineering Lab., Fort Wainright, Alaska. Alaskan Projects Office.
ICE FOG SUPPRESSION USING THIN CHEMICAL FILMS Final Report, Nov. 1975 - Mar. 1977
Terry T. McFadden and Charles M. Collins Jan. 1979 55 p refs Sponsored by EPA
(PB-294275/3; EPA-600/3-79-007) Avail: NTIS HC A04/MF A01 CSCL 13B

Ice fog suppression experiments on the Fort Wainwright Power Plant cooling pond were conducted during the winters of 1974-76. Hexadecanol was added to the pond and dramatically improved visibility by reducing fog generated from water vapor released by the pond at -14 C. Suppression effectiveness at colder temperatures was studied and limits to the techniques were probed. All the films tested were found to be very effective fog reducers at warmer temperatures but still allowed 20% to 40% of normal evaporation to occur. The vapor thus produced was sufficient to create some ice fog at lower temperatures, but this ice fog occured less frequently and was more quickly dispersed than the thick fog that was present before application of the films. GRA

N79-30905# National Bureau of Standards, Washington, D. C.
EXTREME WIND SPEEDS AT 129 STATIONS IN THE CONTIGUOUS UNITED STATES NBS Building Science Series 118
Emil Simiu, Michael J. Changery (Natl. Climatic Center, Asheville, N. C.), and James J. Filliben Mar. 1979 324 p refs Sponsored in part by DOE
(Grant NSF ENV-77-16113)
(PB-295434/5; NBS-BSS-118; LC-79-600018) Avail: NTIS HC A14/MF A01 CSCL 13M

The information presented includes the following: recorded wind speeds and anemometer elevations; predicted wind speeds based on probability distributions of the largest values; estimates of the sampling errors inherent in the predicted wind speeds; a description of the statistical procedure used in the analysis of the data; and a discussion of the results of the analysis. This information is provided to serve as basic documentation from which appropriate decisions can be made on values of design wind speeds to be specified in building codes and standards or on specific projects. GRA

N79-30906# National Hurricane Center, Coral Gables, Fla.
ANNUAL DATA AND VERIFICATION TABULATION ATLANTIC TROPICAL CYCLONES 1978
Paul J. Herbert Apr. 1979 67 p refs
(PB-296323/9; NOAA/TM/NWS/NHC-9; NOAA-79043004) Avail: NTIS HC A04/MF A01 CSCL 04B

An annual series prepared by the National Hurricane Center (NHC) to provide a source of summarized data on Atlantic tropical cyclones is reported. Vertification statistics for the 1978 season are shown in a table. Tropical cyclone warning lead times for United States landfalling storms are given. A summary of warning lead times for the period 1970-1978 for hurricanes only and for both tropical storms and hurricanes is given. A summary of 1978 North Atlantic tropical cyclone statistics is given in a table as well as best track, initial, and forecast positions for 1978 named storms with initial position and forecast errors, and storm average errors. All center fix positions and intensity evaluations used operationally at the National Hurricane Center during 1978 are listed. Supplementary Vortex Data Messages which replaced Vortex Profiles in the 1977 Annual Data Tabulation are given. A diagram of the paths flown in obtaining these Data Messages is shown. The symbolic code for interpreting the Data Messages is given. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N79-30907*# National Oceanic and Atmospheric Administration, Seattle, Wash.
M2, S2, K1 MODELS OF THE GLOBAL OCEAN TIDE Final Report
M. E. Parke and Myrl C. Hendershott Aug. 1979 36 p refs Prepared in cooperation with Scripps Institution of Oceanography, La Jolla, Calif.
(Contract NAS6-2506)
(NASA-CR-156855) Avail: NTIS HC A03/MF A01 CSCL 08C

Ocean tidal signals appear in many geophysical measurements. Geophysicists need realistic tidal models to aid in interpretation of their data. Because of the closeness to resonance of dissipationless ocean tides, it is difficult for numerical models to correctly represent the actual open ocean tide. As an approximate solution to this problem, test functions derived by solving Laplace's Tidal Equations with ocean loading and self gravitation are used as a basis for least squares dynamic interpolation of coastal and island tidal data for the constituents M2, S2, and KI. The resulting representations of the global tide are stable over at least a $\pm 5\%$ variation in the mean depth of the model basin, and they conserve mass. Maps of the geocentric tide, the induced free space potential, the induced vertical component of the solid earth tide, and the induced vertical component of the gravitational field for each contituent are presented. Author

N79-30908# Sandia Labs., Albuquerque, N. Mex.
STATUS OF THE OFFSHORE TECHNOLOGY PROGRAM
Eric W. Reece 1978 9 p refs Presented at the 4th Symp. on Enhanced Oil and Gas Recovery and Improved Drilling Methods, Tulsa, Okla., 29 Aug. 1978
(Contract EY-76-C-04-0789)
(SAND-78-0665; Conf-780825-11) Avail: NTIS HC A02/MF A01

The development of instrumentation systems capable of collecting marine and geologic hazards data in frontier regions of the outer continental shelf is described. Elements common to a variety of remote seafloor instrumentation applications such as acoustic telemetry, digital data acquisition, processing, and storage plus command and control techniques were demonstrated. The design of a seafloor earthquake measurement system was completed. DOE

N79-30909# National Oceanic and Atmospheric Administration, Washington, D. C. Office of Coastal Zone Management.
THE VIRGIN ISLANDS COASTAL MANAGEMENT PROGRAM Final Environmental Impact Statement
Mar. 1979 272 p
(PB-296822/0; NOAA-79050815) Avail: NTIS HC A12/MF A01 CSCL 13B

The process used in developing the coastal zone management program is summarized. The six major Federal requirements involved certain technical tasks, as well as interaction with a wide array of governmental agencies, citizens groups and individuals. These tasks include resource inventories and capability analysis, legal institutional analysis, attitude-value survey, economic and social needs-demand study, and a visual quality-aesthetic assessment. The methodologies and objectives of each are outlined. The program provides a sound basis for decision making, protects the important natural systems and directs uses to areas with natural capabilities and infra-structure capabilities to absorb growth. It will contribute to the long-term maintenance of the environment. GRA

N79-30910# National Oceanic and Atmospheric Administration, Boulder, Colo. Marine Ecosystems Analysis Program Office.
DATA ADMINISTRATION FOR MARINE ECOSYSTEMS ANALYSIS
Paul A. Eisen, Arleamon Sadler, Jr., and Marilyn E. Scheffler Aug. 1978 86 p refs
(PB-293911/4; NOAA-DM-ERL-MESA-36; NOAA-78030705) Avail: NTIS HC A05/MF A01 CSCL 08J

The data administration system for storing and retrieving oceanographic data is presented. The system is to make project data and results readily available to users. The project utilizes 3 strategies for organizing data, two utilizing data files, and 1 data base. The project's method for handling data is a flexible file formating scheme and data catalogue report generation. The total organization of the data system and the strategies (traditional/flexible and data base/key task) are presented. GRA

N79-30911# Woodward-Clyde Consultants, Los Angeles, Calif.
EASTERN GULF OF MEXICO MARINE HABITAT STUDY, VOLUME 1 Final Report, 1978
Jan. 1979 109 p 2 Vol.
(Contract DI-AA551-CT8-22)
(PB-294152/4; BLM/YM/ES-79/03-Vol-1) Avail: HC A06/MF A01 CSCL 08J

The study identified delineated marine habitat areas located on the west Florida shelf. Over 1,930 km of geophysical data were collected from: depth sounders, three 3.5 kHz sub-bottom profiler, a side scan sonar, and a high resolution seismic reflection profiler. GRA

N79-30912# Woodward-Clyde Consultants, Los Angeles, Calif.
EASTERN GULF OF MEXICO MARINE HABITAT STUDY. VOLUME 2: MAPS AND CROSS SECTIONS Final Report
Jan. 1979 30 p 2 Vol.
(Contract DI-AA551-CT8-22)
(PB-294153/2; BLM/YM/ES-79/04-Vol-2) Avail: NTIS HC A03/MF A01 CSCL 08J

Maps of bathymetry and sea bottom type were produced from the collected marine habitat data for each of 10 non-contiguous map areas. Twenty-three transects in six map areas were ground truthed using underwater television and a 35 underwater camera. Over 30 h of videotape and 2,500 color transparencies documented bottom features and associated macrobenthic assemblages. The ground truth and geophysical data were reviewed to identify potentially critical marine habitat areas where further studies may be desired prior to initiation of any offshore operations that could affect the marine habitat. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N79-30913*# Houston Univ., Tex.
EFFECTS OF GRAVITY ON CONTRACTILE PROTEINS Final Report, 1 Jun. 1978 - 31 May 1979
H. R. Henney, Jr. May 1979 35 p refs
(Contract NAS9-14857)
(NASA-CR-160303) Avail: NTIS HC A03/MF A01 CSCL 06C

A method was established for the isolation and purification of nuclei in high yield from the microplasmodia of Physarum flavicomum. Purified nuclei were resistant to breakage by methods commonly employed for isolated plant and animal nuclei. Several methods for the extraction of nuclear protein were compared. Incubation of nuclear lysates with either 2 M NaCl, with or without 5 M urea, or 1 M CaCl2 resulted in the extraction of nuclear action together with histones. The histones were chemically fractionated into the 5 basic groups common to other eucaryotic tissue. Amino acid analyses of the total histone were also performed. Nuclear actin was found to have a molecular weight of 41,000 ± 4,000 daltons as determined by SDS polyacrylamide gel electrophoresis. The amino acid composition of the nuclear action was established. Author

N79-30914# Rice Univ., Houston, Tex. Dept. of Physics.
STUDYING THE STATE OF CELLULAR METAL IONS BY THE EXTENDED X-RAY ABSORPTION FINE STRUCTURE Final Report, 1 Apr. 1977 - 31 Mar. 1979
H. W. Huang 1 Jun. 1979 17 p refs
(Contract N00014-77-C-0239)
(AD-A069799) Avail: NTIS HC A02/MF A01 CSCL 07/2

The edge spectrum is a sensitive probe of local chemistry. Each chemical environment measured here gives a unique edge spectrum. Hydrated potassium also has a unique spectrum which is insensitive to counterions. Comparing spectra we find that the chemical state of potassium in cells differs appreciably from that in aqueous solutions. GRA

N79-30915# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
A SUBHUMAN PRIMATE RESTRAINT SYSTEM
Clarence M. Oloff and William L. Finch Dec. 1978 57 p refs (AF Proj. 7222)
(AD-A069607; AMRL-TR-78-88) Avail: NTIS HC A04/MF A01 CSCL 14/2

The illustrations presented here are of a subhuman primate restraint system that is a novel method of limiting conscious animal movement during experiments. This system is especially useful during acceleration and maintains its structural integrity and usefulness after exposure to high acceleration on a centrifuge. GRA

N79-30916# Tracor Jitco, Inc., Rockville, Md.
REPORT OF THE WORKSHOP ON BIOLOGICAL SCREENING TESTS Final Report
Charles A. Bicking Jan. 1979 52 p refs Workshop held at Las Vegas, Nevada, 12-14 Sep. 1977
(Contract EPA-CB-7-0913-B)
(PB-294303/3; EPA-600/9-79-004) Avail: NTIS HC A04/MF A01 CSCL 06T

The report contains recommendations for selecting substantially predictive biological screening tests. The large number of chemicals which can potentially impact human health and the environment precludes the complete testing of each substance. In order to effect preliminary chemical hazard ranking, initial tests must be standardized and validated and the necessary quality control practices and techniques developed and implemented. Recommendations for selecting substantially predictive biological screening tests upon which the Agency's quality assurance resources may be initially concentrated are included. GRA

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N79-30917 British Library Lending Div., Boston Spa (England).
UNCOMMON HYPERSENSITIVITY TO CONTACTING COLD WATER AND COLD AIR WITH PROPAGATED REFLEX-LIKE ERYTHEMA DEVELOPMENT
J. Petres and I. Kunick May 1979 11 p Transl. into ENGLISH from Hautarzt (Austria), v. 29, no. 8, 1978 p 420-424
(BLL-RTS-11644) Avail: British Library Lending Div., Boston Spa, Engl.

A variant to the currently known atypical forms of cold urticaria is described. Laboratory tests were intercompared with both cold water and cold air contacting in order to study the physical triggering mechanisms of cold urticaria. R.E.S.

N79-30918 British Library Lending Div., Boston Spa (England).
POSSIBILITY OF IMPROVING ASSESSMENT OF CARDIO-PULMONARY FUNCTION BY SUBMAXIMAL EXERCISE ON A BICYCLE ERGOMETER
L. Nachnev May 1979 8 p refs Transl. into ENGLISH from Pneumologiya i Ftiziatriya (Bulgaria), v. 14, no. 2, 1977 p 64-68
(BLL-RTS-11657) Avail: British Library Lending Div., Boston Spa, Engl.

The reference values of the three indices test for young males is presented as well as an experiment to obtain arbitrary

indices with a view to improving the diagnostic value of the test qualitatively and quantitatively. M.M.M.

N79-30919* National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 196
Aug. 1979 46 p
(NASA-SP-7011(196)) HC E03 CSCL 06E

This bibliography lists 126 reports, articles, and other documents introduced into the NASA scientific and technical information system in July 1979. Author

N79-30920# Royal Aircraft Establishment, Farnborough (England).
ULTRASONIC DOPPLER DIRECTIONAL BLOOD FLOW VELOCITY METER
V. S. Postnikov, L. I. Yakimenkov, Yu. N. Gusev, and P. M. Zykov Oct. 1978 8 p refs Transl. into ENGLISH from Izv. Vyssh. Uchebn. Zaved., Priborostr. (USSR), v. 19 no. 4, 1976 p 5-8
(RAE-Lib-Trans-1918; BR67948) Avail: NTIS HC A02/MF A01

A principle for detecting the sense of the velocity of a blood flow using ultrasonic Doppler (USD) meters was investigated. The USD meter operates in single frequency, continuous signal conditions with a combined piezoelectric sender/receiver. R.E.S.

N79-30921*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SPINE IMMOBILIZATION METHOD AND APPARATUS Patent Application
Kenneth H. Lambson (Lambson, Kenneth and Assoc., San Diego, Calif.) and Hubert C. Vykukal, inventors (to NASA) Filed 13 Jul. 1979 16 p
(NASA-Case-ARC-11167-1; US-Patent-Appl-SN-057526) Avail: NTIS HC A02/MF A01 CSCL 06B

A spine immobilization apparatus which uses a normally flat, flexible bladder filled with beads or microballoons is described. The beads form a rigid mass when the pressure within the bladder is decreased below ambient through the use of a suction pump. The bladder can be conformed to the victim's torso to provide the desired restraint. It is strapped to the victim prior to being rigidified by an arrangement of straps which avoid the stomach area. The bladder is adapted to be secured to a rigid support, i.e., a rescue chair, so as to enable removal of a victim after the bladder has been made rigid. A double sealing connector is used to connect the bladder to the suction pump and a control valve is employed to vary the pressure within the bladder so as to soften and harden the bladder as desired. NASA

N79-30922*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DIAGNOSIS OF CUTANEOUS THERMAL BURN INJURIES BY MULTISPECTRAL IMAGING ANALYSIS
Victor J. Anselmo and Bruce E. Zawacki (Univ. of Southern California Medical Center) 1 Sep. 1978 70 p refs Original contains color illustrations
(Contract NAS7-100)
(NASA-CR-162103; JPL-Pub-79-34) Avail: NTIS HC A04/MF A01 CSCL 06E

Special photographic or television image analysis is shown to be a potentially useful technique to assist the physician in the early diagnosis of thermal burn injury. A background on the medical and physiological problems of burns is presented. The proposed methodology for burns diagnosis from both the theoretical and clinical points of view is discussed. The television/computer system constructed to accomplish this analysis is described, and the clinical results are discussed. G.Y.

N79-30923# Oak Ridge National Lab., Tenn.
MUTAGENIC COMPONENTS OF ALTERNATE ENERGY SOURCES
James L. Epler and M. R. Guerin 1978 13 p refs Presented at 71st Air Pollution Assoc. Meeting, Houston, Tex., 25 Jun. 1978
(Contract W-7405-eng-26)
(CONF-780636-8) Avail: NTIS HC A02/MF A01

The use of short term mutagenicity assays to predict the potential biohazard of various crude and complex test materials was examined in a coupled chemical and biological approach. Preliminary chemical characterization and preparation for bioassay, followed by testing in the histidine reversion assay was emphasized. The mutagenicity tests are intended to act as predictors of profound long range health effects such as mutagenesis and/or carcinogenesis, act as a mechanism to rapidly isolate and identify a hazardous biological agent in a complex mixture, and function as a measure of biological activity correlating base line data with changes in process conditions. Mutagenicity tests can also aid in identifying the specific hazardous compounds involved and in establishing priorities for further validative testing, testing in whole animals, and more definitive chemical analysis and monitoring. DOE

N79-30924# California Univ., Berkeley. Lawrence Berkeley Lab.
DEVELOPMENT AND APPLICATION OF RESISTIVE PULSE SPECTROSCOPY: STUDIES ON THE SIZE, FORM AND DEFORMABILITY OF RED BLOOD CELLS Ph.D. Thesis
James P. Yee Jan. 1979 181 p refs
(Contract W-7405-eng-48)
(LBL-8640) Avail: NTIS HC A09/MF A01

The following studies were conducted using the resistive pulse spectroscopy (RPS) technique: cumulative spectra and individual pulse forms for rigid latex polymer spheres; acquisition and analysis of RPS spectral data by means of special computer program; interaction of red blood cells with glutaraldehyde; membrane properties of erythrocytes undergoing abrupt osmotic hemolysis; reversible effects of the binding of chlorpromazine HCl at the red cell membrane surface; effects of high cholesterol diet on erythrocytes of guinea pigs; and multipopulation analysis for a mixture of fetal and maternal red cells. DOE

N79-30925# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany). Inst. fuer Flugmedizin.
COMPATIBILITY TEST OF OXYGEN EXPOSURES IN THE RANGE OF 2.2 TO 2.8 BAR ABSOLUTE
Horst Krekeler, Pierre Cabarrou, and Hans-Dietrich Fust Feb. 1978 32 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-566)
(DLR-FB-78-10) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 13,10

Decompression tests in the range of 100 to 200 m were performed in a pressure chamber. In the course of decompression helium/oxygen mixtures with a maximal O2-partial pressure of 2.5 bar are respired. In a special series of experiments the effect of oxygen on the human organism, in particular on the respiratory system was studied. During 2 consecutive weeks, from Monday to Friday, 4 subjects breathed pure oxygen 30 min at 18 m, 60 min at 15m, and 90 min at 12 m. No significant changes indicating a harmful effect from oxygen breathing were observed. Author (ESA)

N79-30926# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany). Inst. fuer Fluegmedizin.
THE INFLUENCE OF HYPERBARIC ENVIRONMENT IN COMBINATION WITH WORKLOAD AND CONFINEMENT ON HUMAN INFORMATION PROCESSING
Klaus-Martin Goeters Jul. 1978 17 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-567)
(DLR-FB-78-12) Avail: NTIS HC A02/MF A01; DFVLR, Cologne DM 8,20

A test requiring perceptual speed, memory, and numerical ability was given to subjects before and during working conditions with varying degrees of work-load, confinment, and ambient pressure. Results demonstrate that high workload and confinement for several days do not lower the test scores, but rising partial pressure of nitrogen results in performance decerements. These decrements are already present at a N2-partial pressure of 3 bar abs. Author (ESA)

N79-30927# National Technical Information Service, Springfield, Va.
ALTITUDE HYPOXIA, VOLUME 1. A BIBLIOGRAPHY WITH

ABSTRACTS Progress Report, 1964 - 1977
Elizabeth A. Harrison May 1979 251 p 2 Vol.
(NTIS/PS-79/0427/9) Avail: NTIS HC $28.00/MF $28.00 CSCL 06S

Two hundred and forty-four abstracts of research reports are presented which cover the following topics: stress physiology, narcosis, acceleration tolerance, adaptation (physiology), psychophysiology, respiration, metabolism, and cardiovascular system as applied to altitude hypoxia. None of the entries are new.
GRA

N79-30928# National Technical Information Service, Springfield, Va.
ALTITUDE HYPOXIA, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1978 - May 1979
Elizabeth A. Harrison May 1979 23 p Supersedes NTIS/PS-78/0443; NTIS/PS-77/0446; NTIS/PS-76/0378; NTIS/PS-75/237 2 Vol.
(NTIS/PS-79/0428/7; NTIS/PS-78/0443; NTIS/PS-77/0446; NTIS/PS-76/0378; NTIS/PS-75/237) Avail: NTIS HC $28.00/MF $28.00 CSCL 06S

The selected abstracts of research reports cover stress physiology, narcosis, acceleration tolerance, adaptation (physiology), psychophysiology, respiration, metabolism and cardiovascular system as applied to altitude hypoxia. (This updated bibliography contains 14 of which are new entries to the previous edition.)
GRA

N79-30929# National Technical Information Service, Springfield, Va.
BIOLOGICAL EFFECTS OF MICROWAVES, VOLUME 1. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - 1977
Elizabeth A. Harrison May 1979 212 p
(NTIS/PS-79/0432/9) Avail: NTIS HC $28.00/MF $28.00 CSCL 05R

Two hundred and four articles depicting the radiation hazards, tolerances, and effects of microwaves in humans as well as in animals are reported.
GRA

N79-30930# National Technical Information Service, Springfield, Va.
BIOLOGICAL EFFECTS OF MICROWAVES, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1978 - May 1979
Elizabeth A. Harrison May 1979 51 p Supersedes NTIS/PS-78/0432, NTIS/PS-77/0455, NTIS/PS-76/0387 and NTIS/PS-75/384
(NTIS/PS-79/0433/7; NTIS/PS-78/0432; NTIS/PS-77/0455; NTIS/PS-76/0387; NTIS/PS-75/384) Avail: NTIS HC $28.00/MF $28.00 CSCL 06R

The selected abstracts cover the biological effects on man and animals from exposure to microwaves. In addition to dosages and tolerances, regulations, and standards are included. (This bibliography contains 45 abstracts, 29 of which are new entries to the previous edition.)
GRA

N79-30931# Bureau of Radiological Health, Rockville, Md.
SOME CONSIDERATIONS OF HAZARDS IN THE USE OF LASERS FOR ARTISTIC DISPLAYS Final Report
Richard W. Peterson Mar. 1979 21 p refs
(PB-294513/7; DHEW/PUB/FDA-79/8082; FDA/BRH-79/74) Avail: NTIS HC A02/MF A01 CSCL 06R

The nature and magnitude of hazards associated with laser light shows are described. Measures to control access to hazardous radiation are also described. Pulsed, reflected and scanned beams, hazards, and legal obligations are considered.
GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N79-30932# Civil Aeromedical Inst., Oklahoma City, Okla.
THE SELECTION OF AIR TRAFFIC CONTROL SPECIALISTS: TWO STUDIES DEMONSTRATING METHODS TO INSURE AN ACCURATE VALIDITY COEFFICIENT FOR SELECTION DEVICES
James O. Boone and Mary A. Lewis Mar. 1979 11 p refs
(AD-A068581; FAA-AM-79-14) Avail: NTIS HC A02/MF A01 CSCL 05/9

Monte Carlo techniques were employed to demonstrate the effect that recruitment procedures can have on the validity coefficient. It is shown that a more homogeneous group of applications results from highly specific recruitment producing a small applicant group variance considerably reduces the validity coefficient when the coefficient is corrected for selection effects; commonly termed restriction in range. A procedure that eliminates this recruitment problem is discussed. A statistical procedure use when it is necessary to eliminate erroneous data. The procedure employs the notions of statistical distance and probability to identify data that has an extremely small likelihood of belonging to the population of the remaining data set. A.W.H.

N79-30933# Civil Aeromedical Inst., Oklahoma City, Okla.
A COMPARISON OF THE JOB ATTITUDES AND INTEREST PATTERNS OF AIR TRAFFIC AND AIRWAY FACILITY PERSONNEL Final Report
Roger C. Smith Mar. 1979 12 p refs
(AD-A067826; FAA-AM-79-11) Avail: NTIS HC A02/MF A01 CSCL 05/9

Air traffic control specialists (ATCSs) and airway facility technicians (AFTs) were compared on measures of job attitudes and interests. A total of 792 ATCSs and 2,366 AFTs completed the Strong Vocational Interest Blank (SVIB) and questionnaires concerning job satisfaction and job attitudes. Both groups indicated high overall job satisfaction and general agreement about areas of job satisfaction and dissatisfaction. However, ATCSs reported more satisfaction than AFTs from various aspects of the work itself and from salary, while AFTs were more satisfied with responsibility, working conditions, and Civil Service retirement. The AFTs were more favorable to management than ATCSs.
Author

N79-30934# Systems Research Labs., Inc., Dayton, Ohio.
MULTIPURPOSE DIGITAL SWITCHING AND FLIGHT CONTROL WORKLOAD Final Report, Sep. 1974 - Aug. 1977
Billy M. Crawford, William H. Pearson, and Mark S. Hoffman Wright-Patterson AFB, Ohio AMRL Dec. 1978 35 p refs (Contract F33615-75-C-0127; AF Proj. 2050; AF Proj. 7184)
(AD-A069606; AMRL-TR-78-43) Avail: NTIS HC A03/MF A01 CSCL 01/3

Four subjects were tested in a cockpit simulator using a secondary task to measure reserve information processing capacity under two levels of flight control and four levels of multifunction switching. Results suggest that flight control impacts both input-output and central processing stages whereas mere anticipation of switching tasks effects input-output only. Difficult flight control reduced the effective information processing reserve by 54 percent on the average. The corresponding losses attributable to anticipation of multifunction switching were 20 and 31 percent for simple and complex tasks respectively. The study has implications for design of effective digital processing aids and mental workload measurement.
GRA

N79-30935# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany). Inst. fuer Flugmedizin.
PERSONALITY PROFILES OF DIVERS INVOLVED IN RESEARCH ACTIVITIES
Klaus-Martin Goeters Aug. 1978 25 p refs In GERMAN; ENGLISH summary
(DLR-FB-78-11) Avail: NTIS HC A02/MF A01; DFVLR, Cologne DM 10,70

Twenty-two experienced divers and 19 student divers (first week of training) answered the personality questionnaire TSS. A significant difference between subjects with and without diving experience is observed in the scale Personal Warmth. Here, the scores increase with experience. The remaining scales show no difference between divers and student divers. Obviously, the personality of divers is not very much influenced by diving activites. The typical diver scores high in mobility, aggressiveness, and

emotional stability, but low in rigidity, extroversion, and pretentious style of life. Divers do not differ from the normative mean in need of achievement, dominance, and vitality. Author (ESA)

N79-30936# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany). Inst. fuer Flugmedizin.
PSYCHOLOGICAL SELECTION OF SPACELAB PAYLOAD SPECIALISTS: THE EVALUATION OF GERMAN APPLICANTS
Klaus-Martin Goeters Oct. 1978 33 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-586)
(DLR-FB-78-29) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 13,20

Criteria and methods for the psychological selection of scientific astronauts (payload specialists) are described. Results from the evaluation of 103 German Spacelab applicants are reported. The screening tests revealed potentially poor performance and/or personnality problems for a number of applicants. Only 30 percent of all applicants were fully accepted. Author (ESA)

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N79-30937*# General Electric Co., Philadelphia, Pa. Space Div.
AUTOMATED BIOWASTE SAMPLING SYSTEM FECES MONITORING SYSTEM Final Report
S. R. Hunt and E. J. Glanfield 31 Jul. 1979 186 p
(Contract NAS9-15159)
(NASA-CR-160301; Doc-79SDS028) Avail: NTIS HC A09/MF A01 CSCL 06K

The Feces Monitoring System (FMS) Program designed, fabricated, assembled and tested an engineering model waste collector system (WCS) to be used in support of life science and medical experiments related to Shuttle missions. The FMS design was patterned closely after the Shuttle WCS, including: interface provisions; mounting; configuration; and operating procedures. These similarities make it possible to eventually substitute an FMS for the Shuttle WCS of Orbiter. In addition, several advanced waste collection features, including the capability of real-time inertial fecal separation and fecal mass measurement and sampling were incorporated into the FMS design. G.Y.

N79-30938# Civil Aeromedical Inst., Oklahoma City, Okla.
VISUAL SEARCH PERFORMANCE DURING SIMULATED RADAR OBSERVATION WITH AND WITHOUT A SWEEP-LINE Final Report
Richard I. Thackray and R. Mark Touchstone Mar. 1979 17 p refs
(AD-A068020; FAA-AM-79-12) Avail: NTIS HC A02/MF A01 CSCL 05/5

A study was conducted to determine whether or not the presence or absence of a radar sweepline influences attentional processes and, hence, the speed with which critical stimuli can be detected. The visual display was designed to approximate an advanced, highly automated air traffic control radar display containing computer-generated alphanumeric symbols. Twenty-eight men and women, paid volunteers with no previous air traffic controller experience, were tested over a 2-hour session with half of the subjects assigned to the sweep condition and half to the no-sweep condition. Author

N79-30939# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
A DECISION, MONITORING AND CONTROL MODEL OF THE HUMAN OPERATOR APPLIED TO AN RPV CONTROL PROBLEM Final Scientific Report
Ramal Muralidharan, Sheldon Baron, and Carl E. Feehrer Mar. 1979 96 p refs
(Contract F44620-76-C-0029)
(AD-A069880; BBN-4075; AFOSR-79-0675TR) Avail: NTIS HC A05/MF A01 CSCL 05/5

This report describes application of a decision-making, monitoring and control model (DEMON) for the human operator to a task involving control of Remotely Piloted Vehicles (RPVs). The DEMON model is an extension of the Optimal Control Model (OCM) of the operator derived by infusion decision theoretic notions into the basic OCM structure. The resulting model is designed to treat situations in which control actions may be infrequent and monitoring and decision-making are the operator's main tasks. The analysis of this problem illustrates some of the major considerations in applying DEMON to complex, supervisory control problems. It shows that with fairly straightforward assumptions about the operator's task, DEMON will give reasonable predictions of performance. However, the model results are not compared with actual data so DEMON is presently unvalidated. The development of DEMON was part of a three year research program for the Air Force Office of Scientific Research aimed at investigating human performance models. The report also provides a brief summary of the overall effort. GRA

N79-30940# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
DEVELOPMENT OF HUMAN PERFORMANCE MODELS FOR MAN-MACHINE SYSTEM SIMULATION Interim Report, 1 Oct. 1976 - 30 Sep. 1977
Duncan C. Miller, Ramal Muralidharan, Sheldon Baron, Carl E. Feehrer, and Richard W. Pew Oct. 1978 78 p refs
(Contract F44620-76-C-0029; AF Proj. 2313)
(AD-A069879; BBN-3739; AFOSR-79-0674TR) Avail: NTIS HC A05/MF A01 CSCL 05/5

This report contains discussions and program flow charts pertinent to bottom-up and top-down models developed by BBN to predict the performance of RPV controllers. Included are brief discussions of the control task itself and of problems and issues encountered during model development. GRA

N79-30941# Perceptronics, Inc., Woodland Hills, Calif.
ADAPTIVE ESTIMATION OF INFORMATION VALUES IN CONTINUOUS DECISION MAKING AND CONTROL OF ADVANCED AIRCRAFT Annual Technical Report
Randall Steeb, Kent Davis, Yoram Alperovitch, and Amos Freedy Dec. 1978 79 p refs
(Contract F44620-76-C-0094; AF Proj. 2313)
(AD-A069741; PATR-1037-78-12; AFOSR-79-0691TR) Avail: NTIS HC A05/MF A01 CSCL 05/8

This report describes research and development centered on evaluation of information needs in advanced aircraft operations. The selection of information for display is a recurrent, subjective decision involving many factors -- aircraft state, environmental conditions, operator capabilities, and acquisition costs, among others. An adaptive computer model has been developed which incorporates these factors into a multi-attribute decision model. The program is designed to capture the operator's information seeking policy using a training algorithm based on pattern recognition techniques. The individual policy is then used for information system evaluation and for automated information management. Experimental tests of the adaptive modeling and information management approaches were made using a task simulation resembling multiple intercept operations in advanced aircraft. Individual subjects (12 in study) navigated a simulated aircraft through a hazardous, changing environment. In doing so, the operators selected from five information sources of varying content, cost, delay and detectability. The information was then used to take one of a number of control actions. Information management; using either adaptive estimation or off-line direct policy elicitation, was found to result in improved task performance over manual selection, particularly in high speed stress conditions. The adaptive estimation technique was found to be superior to direct policy elicitation, both for automated information management and as a basis for information source evaluation. Possible applications of the techniques are also discussed. GRA

N79-30942# Illinois Univ. at Urbana-Champaign. Engineering-Psychology Lab.
DEVELOPMENT AND UTILIZATION OF INTERNAL MODELS IN DYNAMIC SYSTEMS: A COMPARISON OF MONITORS AND OPERATORS AS FAILURE DETECTORS Interim Report
Colin Kessel and Christopher D. Wickens Dec. 1978 102 p

refs
(Grant AF-AFOSR-3380-77)
(AD-A069730; EPL-78-2/AFOSR-78-5; AFOSR-79-0683TR)
Avail: NTIS HC A06/MF A01 CSCL 05/8

The development of the internal model as it pertains to the detection of step changes in the order of control dynamics is investigated for two modes of participation: when the subjects are actively controlling those dynamics and when they are monitoring the same dynamics under autopilot control. The experiment used a transfer of training design to evaluate the relative contribution of proprioception and visual information to the overall accuracy of the internal model. The subjects either tracked or monitored the system dynamics of a 2-dimensional pursuit display under single task conditions and concurrently with a sub-critical tracking task at two difficulty levels. Detection performance was faster and more accurate in the manual as opposed to the autopilot mode. The cue utilization strategies of the subjects were analyzed by ensemble averaging technique and it was found that monitors of automatic systems who have had prior manual experience rely upon different perceptual cues in making their detection responses than those who have not. The proprioception channel was found to have an attention focusing role and once incorporated into the internal model this attention focusing mechanism can be used to advantage even when there is no proprioceptive feedback. GRA

N79-30943# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Plant.

IMPROVED AIRLINE-TYPE SUPPLIED-AIR PLASTIC SUIT

L. Jolley, Jr., D. B. Zippler, C. H. Cofer, and J. A. Harper Jun. 1978 15 p ref
(Contract EY-76-C-09-0001)
(DPSPU-78-30-12; Conf-780657-3) Avail: NTIS HC A02/MF A01

Two piece supplied-air plastic suits are used extensively at the Savannah River Plant for personnel protection against inhalation of airborne plutonium and tritium. Worker comfort and noise level problems gave impetus to development of an improved suit and aid distribution system. The resulting plastic suit and development work are discussed. The plastic suit unit cost is less than $20, the hearing zone noise level is less than 75 dBA, protection factors exceed 10,000, and user comfort is approved. This suit is expected to meet performance requirements for unrestricted use. DOE

N79-30944# Ingenieurbuero fuer Ergonomie, Munich (West Germany).

ERGONOMIC RESEARCH INTO HUMAN TOLERANCES FOR ROLL AND PITCH AS WELL AS THEIR INFLUENCE ON INDIVIDUAL PERCEPTION AND REACTIONS TO CONTROL PARAMETERS [ERGONOMISCHE UNTERSUCHUNGEN UEBER DIE ZUMUTBARKEIT VON ROLL- UND NICKSWINGUNGEN UND DEREN EINFLUSS AUF DIE AUFNAHME UND VERABEITUNG VON INFORMATIONEN DURCH DEN MENSCHEN]

Peter Bubb Bonn Bundesmin. der Verteidung Sep. 1978 71 p refs In GERMAN; ENGLISH summary
(BMVG-FBWT-78-18) Avail: NTIS HC A04/MF A01; Bundesmin. der Verteidung, Bonn DM 30

Various flight conditions are compared for their effect on human control performance. The decrease in tracking efficiency under random roll conditions is also evaluated. Controlled elements were selected in reference to the literature. The dynamic properties of the controlled elements were normalized to be characteristic of a low frequency input signal. A tracking task was introduced which was compensatory in two dimensions. Results indicate that low order vibration stress has a greater effect on tracking performance than high order vibration inputs. Further investigations of data point out that the tracking error is not simply composed of an independent input-correlated vibration correlated error-term. It is assumed that these results are due to an adaptive variation of parameters describing the motor processes of the human operator. Author (ESA)

N79-30945# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.

A STUDY OF PILOT/OBSERVED INTERACTION IN ALIGNING A HELICOPTER WITH A TARGET

Erhard Danneburg Nov. 1978 34 p In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-480)
(DLR-FB-79-04) Avail: NTIS HC A03/MF A01

Speed and stability of the alignment of a helicopter with a target are investigated by means of a system simulation. Variables are the maximum yaw rate of the helicopter, the maximum pan rate of the steerable sight or sensor and their optical magnification. The results obtained provide favorable combinations of these parameters for two different cases, i.e. target acquisition and target already picked by means of the sight or sensor, respectively. Author (ESA)

N79-30946# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.

A METHOD FOR SEMI-AUTOMATIC ANALYSIS OF EYE MOVEMENTS

Hans Radke Dec. 1978 33 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-475)
(DLR-Mitt-79-02) Avail: NTIS HC A03/MF A01

A semi-automatic computer aided procedure for analyzing data on human eye movement/point-of-regard relationships is described. The use of this technique for the measurement and analysis of a pilot's visual behavior is demonstrated. The resultant data is used for human factors research into the optimal layout of displays and controls in a cockpit. Compared with previous techniques for gathering eye-point-of-regard data, which were difficult and time-consuming, the computer aided method show considerable reduction in the time needed for data analysis. Author (ESA)

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N79-30947*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

CONCURRENT ERROR DETECTING CODES FOR ARITHMETIC PROCESSORS

Raymond S. Lim Aug. 1979 27 p refs
(NASA-TP-1528; A-7810) Avail: NTIS HC A03/MF A01 CSCL 09B

A method of concurrent error detection for arithmetic processors is described. Low-cost residue codes with check-length l and checkbase m = 2 to the l power - 1 are described for checking arithmetic operations of addition, subtraction, multiplica-

tion, division complement, shift, and rotate. Of the three number representations, the signed-magnitude representation is preferred for residue checking. Two methods of residue generation are described: the standard method of using modulo m adders and the method of using a self-testing residue tree. A simple single-bit parity-check code is described for checking the logical operations of XOR, OR, and AND, and also the arithmetic operations of complement, shift, and rotate. For checking complement, shift, and rotate, the single-bit parity-check code is simpler to implement than the residue codes. G.Y.

N79-30948# Illinois Univ. at Urbana-Champaign. Coordinated Science Lab.
LEVELS OF REPRESENTATION OF PROGRAMS AND THE ARCHITECTURE OF UNIVERSAL HOST MACHINES
Rau B. Ramakrishna Aug. 1978 56 p
(Contract DAAB07-72-C-0259)
(AD-A069777; R-819; UILU-ENG-78-2212) Avail: NTIS HC A04/MF A01 CSCL 09/2

The issue of high level language support is treated in a systematic top down manner. Program representations are categorized into three classes with respect to a host processor: high level representations, directly interpretable representations and directly executable representations. The space of intermediate languages for high level language support is explored and it is shown that whereas the ideal intermediate language from the point of view of execution time is directly executable one, the best candidate from the viewpoint of memory requirements is a heavily encoded directly interpretable representation. The concept of dynamic translation is advanced as a means for achieving both goals simultaneously; the program is present in the memory in a compact static representation, but its working set is maintained in a dynamic representation which minimizes execution time. The architecture and organization of a universal host machine, incorporating this strategy is outlined and the potential performance gains due to dynamic translation are studied. GRA

N79-30949# Naval Surface Weapons Center, Dahlgren, Va.
ERROR HANDLING IN THE TRIDENT COMPILER Final Report
Hartmut G. Huber Sep. 1978 41 p refs
(AD-A069496; NSWC/DL-TR-3838) Avail: NTIS HC A03/MF A01 CSCL 09/2

This paper describes briefly the error recovery strategy used within the LALR parser of the TRIDENT Compiler. The main part deals with an analysis of error situations that can occur in a Context Parser. This analysis is based on a classification of terminals, non-terminals, and heads according to certain syntactic characteristics. This information can be encoded in a table which allows error recovery to be table driven. This approach is used in the TRIDENT Compiler for parsing statements and expressions. GRA

N79-30950# Kansas State Univ., Manhattan. Dept. of Computer Science.
FUNCTIONALLY DISTRIBUTED COMPUTING SYSTEMS USER FACILITY DEVELOPMENT Final Report, 1 Jan. 1978 - 31 Jan. 1979
Fred Maryanski 31 Jan. 1979 13 p refs
(Grant DAAG29-78-G-0018)
(AD-A069393; ARO-15552.1-EL) Avail: NTIS HC A02/MF A01 CSCL 09/2

Under a grant from the Army Research Office, Kansas State University investigated and studied the feasibility of establishing the multiple minicomputers of the School of Aerospace Medicine into a network of computer resources. A PDP 11/70 and a PDP 11/34 were acquired for use as host computer in a distributed processing configuration. Simulations were written to test the network concept prior to installation. The report describes the result of the investigation. GRA

N79-30951# Armstrong (Philip N.), Santa Ana, Calif.
COMPUTATION WITH SERIAL MEMORY SYSTEMS Final Technical Report
Philip N. Armstrong and Martin Rem (Technische Hogeschool, Eindhoven, Netherlands) Feb. 1979 64 p refs
(Contract N00014-78-C-0357)
(AD-A068137) Avail: NTIS HC A04/MF A01 CSCL 09/2

This paper examines the question of whether it is possible to substitute serial memory for conventional random access memory (RAMs) in commonly encountered numerical computations. There is much interest in tasks such as arge/solving large arge systems of linear equations, large linear programming problems, and other calculations applied to large amounts of data concurrently with development of techniques for constructing large serial memories which are intrinsically less expensive than comparable RAMs. The answer to the question is 'yes' for those computations discussed in this paper if the serial memory is equipped with compare/exchange circuits so that it will sort its contents. Generally, when using self-sorting memory, labels or keys are appended to the data to be stored; conventional machine addresses are not to be used. Data entries thus specified pass to simple arithmetic processors for the requisite numerical operations, after which the data may be returned to the self-sorting memory for retention until needed again. A property common to all computations discussed in this paper is the feasibility of computing the requisite memory output sequence as data is first passed to the memory, as well as in the course of computation. While there is clearly no analytic basis for asserting that the class of all common numerical computations shares this property, many computations not discussed in this paper are clearly within this class. GRA

N79-30952# Naval Surface Weapons Center, White Oak, Md. Research and Technology Dept.
PROGRESS TOWARD THE CROSSTIE MEMORY 6 Annual Report, Oct. 1977 - Sep. 1978
L. J. Schwee, W. E. Anderson, Y. J. Liu, Oscar VanSant, and Emma Lee Hebb 12 Mar. 1979 33 p refs
(WF54545602)
(AD-A069663; NSWC/WOL/TR-79-97; AR-6) Avail: NTIS HC A03/MF A01 CSCL 09/2

This is the sixth annual technical report of progress toward the crosstie memory and it emphasizes work done during the past year. The five previous reports can be obtained upon request of the authors. Progress has proceeded to the point where shift registers can be demonstrated under observation with Bitter solution. Propagation experiments at NSWC were successful along the entire length of the shift register except where the bit enters the detector. Efforts being made to optimize operation are detailed in this report. With the use of Bitter solution a 12 megabit/sec shift rate was demonstrated. Detection at a 1 megabit/sec rate has been demonstrated at Univac. The next step is to demonstrate data in and data out at a high rate. GRA

N79-30953# Sandia Labs., Albuquerque, N. Mex.
MULTIPLE PRECISION INTEGER OPERATION PACKAGE FOR CDC 6600 AND 7600
Richard J. Hanson Feb. 1979 40 p refs
(Contract EY-76-C-04-0789)
(SAND-79-0069) Avail: NTIS HC A03/MF A01

A package of FORTRAN codes was developed for certain multiple precision integer operations. These operations include basic arithmetic, modular exponentiation, and conversion of numbers to and from decimal representation. The package is specialized to run on the CDC 6600 or 7600. It is not portable due to the fact that it uses the CDC supported Boolean intrinsic functions. Both efficiency and reliability were achieved in the package. Efficiency was achieved by exploiting the intrinsic Boolean functions (MASH, etc.) in the implementation of the arithmetic. Reliability is maintained by cross-checking both the lengths of internal working storage arrays against the requirements of the operations, and the size and sign of the internal representation of the digits. DOE

N79-30954# Sandia Labs., Albuquerque, N. Mex.
JUSTIFICATION FOR CLASS 6 SCIENTIFIC COMPUTING CAPABILITY AT SANDIA LABORATORIES, ALBUQUERQUE
Feb. 1979 36 p
(Contract EY-76-C-04-0789)
(SAND-79-0488) Avail: NTIS HC A03/MF A01

It is increasing problem complexity, plus the need to solve problems with greater confidence and accuracy in a timely fashion, that has generated the need for significantly enhanced scientific computing capacity and capability for Sandia in the near future.

Accordingly, Sandia is requesting a Class 6 computer for FY 81 Such a computer is capable of 20 to 6 million floating point operations per second. DOE

N79-30955# National Bureau of Standards, Washington, D. C. Inst. for Computer Sciences and Technology.
GUIDE TO TECHNICAL SERVICES AND INFORMATION SOURCES FOR ADP MANAGERS AND USERS
Shirley M. Radack Apr. 1979 51 p refs
(PB-294845/3; NBSIR-79-1734) Avail: NTIS HC A04/MF A01 CSCL 09B

Technical services and resources available to Federal ADP managers and users from other agencies in the U.S. Government are described. The names, addresses and telephone numbers of the agencies providing computer-related services and information are included. Subject areas covered include ADP standards, reports, management, performance evaluation, training, magnetic media, software, security and technical assistance. Information about Federal Information Processing Standards, Federal Standards for data communications, OMB policy guidance for ADP, procurement regulations and GSA regional services is reported. Federally sponsored ADP users' groups are listed. Sources are given for the documents and publications are cited. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N79-30956*# Computer Sciences Corp., Houston, Tex. Applied Technology Div.
PROGRAM DOCUMENTATION FOR THE SPACE ENVIRONMENT TEST DIVISION POST-TEST DATA REDUCTION PROGRAM (GNFLEX)
L. D. Jones Jun. 1979 157 p refs
(Contract NAS9-15700)
(NASA-CR-160310; CSC-0419; JSC-14915) Avail: NTIS HC A08/MF A01 CSCL 09B

The Space Environment Test Division Post-Test Data Reduction Program processes data from test history tapes generated on the Flexible Data System in the Space Environment Simulation Laboratory at the National Aeronautics and Space Administration/Lyndon B. Johnson Space Center. The program reads the tape's data base records to retrieve the item directory conversion file, the item capture file and the process link file to determine the active parameters. The desired parameter names are read in by lead cards after which the periodic data records are read to determine parameter data level changes. The data is considered to be compressed rather than full sample rate. Tabulations and/or a tape for generating plots may be output. Author

N79-30957*# Lockheed Electronics Co., Houston, Tex.
ADDITION OF A DEMAND PLOTTING CAPABILITY TO SINDA Computer Program Documentation
S. J. Damico May 1979 13 p ref
(Contract NAS9-15800)
(NASA-CR-160299; LEC-13338; JSC-14821) Avail: NTIS HC A02/MF A01 CSCL 09B

The use of the DISSPLA plotting package to write a routine to be added to SINDA is described. This routine, DISPX1, allows the data within a SINDA execution to be plotted in the demand mode. K.L.

N79-30958# California Univ., Berkeley. Lawrence Berkeley Lab.
A COMPARISON OF BKY-FTN4 AND VAX-FORTRAN
Christopher Horne and Barrie Pardoe Aug. 1978 56 p refs
(Contract W-7405-eng-48)
(LBL-7978) Avail: NTIS HC A04/MF A01

A guide is presented for porting FORTRAN 4 programs between the CDC machines at the Lawrence Berkeley Laboratory and the VAX. Language constructs which will cause trouble are indicated and a minimal language which requires only minor alteration to run on either machine is given. A.R.H.

N79-30959# Computer Sciences Corp., Silver Spring, Md. Systems Sciences Div.
CENTRAL FLOW CONTROL SOFTWARE DESIGN DOCUMENT. VOLUME 1: OPERATIONAL SOFTWARE COMPLEX Final Report
Jan. 1979 542 p refs
(Contract DOT-FA77WA-3955)
(AD-A070973; CSC/SD-78/6172-Vol-1; FAA-RD-79-33-Vol-1)
Avail: NTIS HC A23/MF A01 CSCL 09/2

The Central flow control (CFC) software system functional requirements established in the Federal Aviation Administration's (FAA) computer program functional specifications are translated into implemented software programs. The exact configuration of the computer programs produced for CFC software system is described. A complete technical description of the software functions, structures, operating environment, data organization, visual table of contents, program listings, and data and module cross references is provided. The operational complex which operates in real time mode and is comprised of the executive, database, simulation, and applications subsystems is described. J.M.S.

N79-30960# Computer Sciences Corp., Silver Spring, Md. Systems Sciences Div.
CENTRAL FLOW CONTROL SOFTWARE DESIGN DOCUMENT. VOLUME 2: SUPPORT SOFTWARE COMPLEX Final Report
Jan. 1979 593 p
(Contract DOT-FA77WA-3955)
(AD-A070771; CSC/SD-78/6172-Vol-2; FAA-RD-79-33-Vol-2)
Avail: NTIS HC A25/MF A01 CSCL 09/2

The support complex (SPCX) which operates in an off-line mode and is comprised of the system development, system generation, system test, and system analysis subsystems is described. J.M.S.

N79-30961# University of Southwestern Louisiana, Lafayette. Dept. of Computer Science.
IMPLEMENTATION AND EVALUATION OF INTERNAL ARITHMETIC SOFTWARE. REPORT 2: THE HONEYWELL MULTICS SYSTEM
S. Podlaska-Lando, Eric K. Reuter, and Bruce D. Shriver Apr. 1979 91 p refs
(Contracts DACA39-76-M-0249; DACA39-77-M-0101)
(AD-A069858; WES-TR-O-79-1-2) Avail: NTIS HC A05/MF A01 CSCL 09/2

This is Report 2 of a series entitled Implementation and Evaluation of Interval Arithmetic Software. Interval arithmetic can be used to determine the precision of the arithmetic required to guarantee a given precision in the results of an algorithm. In general, whether using interval or regular arithmetic, the greater the precision the longer the run time required for a given algorithm. A 56 decimal digit version of the original MULTICS interval package was implemented on the MULTICS system. It is concluded that the use of single precision and 56 decimal digit extended precision interval arithmetic can, at times, be extremely useful. The testing showed that, when using the 56 decimal digit data type, much better bounds were obtained for the results than when using the single precision interval data type. GRA

N79-30962# System Development Corp., Santa Monica, Calif.
SOFTWARE DEBUGGING METHODOLOGY, VOLUME 1 Final Technical Report, Sep. 1977 - Oct. 1978
Marcia Finfer, Jon Fellows, and Dan Casey Griffiss AFB, N. Y. RADC Apr. 1979 172 p refs 3 Vol.
(Contract F30602-77-C-0165)
(AD-A069539; RADC-TR-79-57-Vol-1) Avail: NTIS HC A08/MF A01 CSCL 09/2

A debugging study was conducted which surveyed current research being performed in the area of software debugging during integration-level testing. Particular emphasis was placed on assessing debugging tools and techniques which were applicable to embedded software developments. The purpose of the debugging study was to define a software debugging methodology applicable to diverse environments to be utilized

during integration testing of system software. The results of the study are contained in three volumes. This volume presents a discussion of generic debugging information requirements which are used in the activities needed for integration-level debugging. Those activities are described in a debugging methodology which defines a logical progression of steps, or processes, deemed necessary to solve complex errors in system software. Many of the steps in the methodology are characterized as human thought processes and are, at best, rudimentarily described. Other processes are presented as support activities to these thought processes and include information identification, derivation, and collection. These processes require the use of debugging tools, which are generically described, for optimizing the efficiency of debugging activities. Considerations of the effect of different hardware/software environments on the debugging methodology and information requirements are also described. GRA

N79-30963# System Development Corp., Santa Monica, Calif.
SOFTWARE DEBUGGING METHODOLOGY. VOLUME 2: HANDBOOK FOR DEBUGGING IN THE MULTICS/GCOS/RTM ENVIRONMENTS Final Technical Report, Sep. 1977 - Oct. 1978
Marcia Finfer, Jon Fellows, and Dan Casey Griffiss AFB, N. Y. RADC Apr. 1979 122 p
(Contract F30602-77-C-0165)
(AD-A069540; RADC-TR-79-57-Vol-2) Avail: NTIS HC A06/MF A01 CSCL 09/2

A debugging study was conducted which surveyed current research being performed in the area of software debugging during integration level testing. Particular emphasis was placed on assessing debugging tools and techniques which were applicable to embedded software developments. The purpose of the debugging study was to define a software debugging methodology applicable to diverse environments to be utilized during integration testing of system software. The results of the study are contained in three volumes. This volume presents the application of the debugging methodology to three specific environments. GRA

N79-30964# System Development Corp., Santa Monica, Calif.
SOFTWARE DEBUGGING METHODOLOGY. VOLUME 3: LITERATURE AND SITE SURVEYS Final Technical Report, Sep. 1977 - Oct. 1978
Marcia Finfer, Jon Fellows, and Dan Casey Griffiss AFB, N. Y. RADC Apr. 1979 198 p refs
(Contract F30602-77-C-0165)
(AD-A069541; RADC-TR-79-57-Vol-3) Avail: NTIS HC A09/MF A01 CSCL 09/2

A debugging study was conducted which surveyed current research being performed in the area of software debugging during integration-level testing. Particular emphasis was placed on assessing debugging tools and techniques which were applicable to embedded software developments. The purpose of the debugging study was to define a software debugging methodology applicable to diverse environments to be utilized during integration testing of system software. The results of the study are contained in three volumes. This volume presents the body of information used to derive the debugging methodology. GRA

N79-30965# Science Applications, Inc., Englewood, Colo.
A COMPARATIVE STUDY OF FLOWCHARTS AND PROGRAM DESIGN LANGUAGES FOR THE DETAILED PROCEDURAL SPECIFICATION OF COMPUTER PROGRAMS Technical Report, 12 Jul. 1976 - 11 Nov. 1977
H. Rudy Ramsey, Michael E. Atwood, and James R. VanDoren (Oklahoma State Univ.) Sep. 1978 175 p refs
(Contract DAHC19-76-C-0040; DA Proj. 2Q7-62725-A-778)
(AD-A069604; SAI-78-078-DEN; ARI-TR-78-A22) Avail: NTIS HC A08/MF A01 CSCL 09/2

An experiment was performed to assess the relative merits of Program Design Languages (PDLs) and flowcharts as techniques for the development and documentation of detailed designs for computer programs. Twenty students in a computer science graduate course participated in this experiment. Working individually, the students designed a two-pass assembler for a simple minicomputer. Half the students expressed their design for the first pass of the assembler in the form of a flowchart, and expressed their design for the second pass in a Program Design Language. The other half of the students used a PDL for pass one, and a flowchart for pass two. Flowcharts and PDLs were compared on the basis of various measures of overall design quality, design errors, level of detail of designs, time expended in developing designs, and subjective preferences. Overall, the results suggest that software design performance and designer-programmer communication might be significantly improved by the adoption of informal Program Design Languages, rather than flowcharts, as a standard documentation method for detailed computer program design. GRA

N79-30966# Naval Surface Weapons Center, Dahlgren, Va.
CONFIGURATION DESCRIPTION LANGUAGE PROCESSOR DESIGN DISCLOSURE Final Report
Donald J. Lemoine Oct. 1978 70 p refs
(AD-A069437; NSWC/DL-TR-3881) Avail: NTIS HC A04/MF A01 CSCL 09/2

The Configuration Description Language System (CDL) was developed to support a complex fire control simulation (TRICS) and the Advanced Weapon System Simulation Program (AWSS). Both of these systems are large simulations which require the facility for modifying the linkage between software components through input directives. The concepts used in representing program configurations with CDL represent a departure from conventional methods of varying the way in which major program components connect. Program flows are described in a very high level language, through input directives, thus producing configurations that are readable and self-documenting. The system frees the experimenter from having to know the details of the system but at the same time permits the reference and use of actual program components. The CDL system was developed not only to serve the user but also the programmer. It performs the work normally done by the programmer in interfacing the users' CDL with the actual program. The CDL system is coded in the SIMSCRIPT II.5 language, version 4.0 and is operational on the CDC 6700 computer system under the SCOPE 3.4 operating system. GRA

N79-30967# Yale Univ., New Haven, Conn. Dept. of Computer Science.
THE ROLE OF OBJECT PRIMITIVES IN NATURAL LANGUAGE PROCESSING
Wendy G. Lehnert and Mark H. Burstein May 1979 33 p refs
(Contract N00014-75-C-1111)
(AD-A069861; RR-162) Avail: NTIS HC A03/MF A01 CSCL 05/7

Natural language processing techniques rely in part on the use of functional knowledge about physical objects, and associative memory structure. In this paper, a representational system called Object Primitives is presented as an extension to the system of Conceptual Dependency for the purpose of representing physical objects and providing an organizing structure for associative memory. A computer program, OPUS, is described which applies this representational system to the problem of analyzing natural language sentences dealing with objects. Inferences derived from Object Primitive descriptions are made during the conceptual analysis by a system of demons, providing a framework for an integrated understanding system. GRA

N79-30968# Illinois Univ. at Urbana-Champaign. Coordinated Science Lab.
DIAGNOSIS, SELF-DIAGNOSIS AND ROVING DIAGNOSIS IN DISTRIBUTED DIGITAL SYSTEMS
Ravindra Kumar Nair Sep. 1978 44 p refs
(Contract DAAB07-72-C-0259)
(AD-A069770; R-823; UILU-ENG-78-2216) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report studies various problems related to the diagnosis of systems which may be conveniently partitioned into subsystems on modules capable of performing tests among themselves. Traditionally, system diagnosis has aimed at the detection of one or more faulty units in systems. In certain critical operations like large distributed systems, it is desirable to know precisely which units in the system are fault-free. The report first considers the problem of determining at least one fault-free unit in a system. Necessary and sufficient conditions, as well as more

convenient sufficient conditions for solving the problem have been obtained. The 'roving diagnosis' scheme introduced in the report is an attempt to achieve self-diagnosis in distributed digital systems while involving as few units in diagnosis as possible at any given time. A 'window' is associated with the subsystem composed of the testing and tested units. Diagnosis of the entire system is achieved by moving this window around the system. Related issues which are studied include reconfiguration of the system under a fault and the reusability of the system after reconfiguration. Certain properties of the system communications graph are shown to lead to desirable systems where the delay in reconfiguring around a fault is small. GRA

N79-30969# Arcon Corp., Waltham, Mass.
MATHEMATICAL MODELLING Final Technical Report, 1 Sep. 1976 - 30 Apr. 1978
Stanley Woolf and Edward Cohen Griffiss AFB, N. Y. RADC Apr. 1979 187 p refs
(Contract F19628-76-C-0247; AF Proj. 2306)
(AD-A069665; RADC-TR-79-65) Avail: NTIS HC A09/MF A01 CSCL 09/2

In this report we will describe the techniques and computer programs developed to analyze various problems. The scope of our work extended into three technical areas: the problem of electron scattering and transport in solids; the design of surface acoustic wave devices, and the study of phase-constrained guided modes in dielectric slabs. GRA

N79-30970# Sandia Labs., Albuquerque, N. Mex.
SOME PDP-11 BASIC-11 EXTENSION ROUTINES
N. A. Bourgeois, Jr. Mar. 1979 70 p refs
(Contract EY-76-C-04-0789)
(SAND-79-0292) Avail: NTIS HC A04/MF A01

Some extension routines to Digital Equipment Corporation's BASIC-11 V2 interpreter running under RT-111 V03 are described. The means for reading (GET, GETB, TBIT) and writing (PUT, PUTB, SBIT) words, bytes, and bits at any implemented UNIBUS address, identifying (IDEN) the extended BASIC-11 interpreter, and zeroing (NULL) arrays are provided. DOE

N79-30971# California Univ., Livermore. Lawrence Livermore Lab.
COLLECTION OF SOFTWARE FOR ORDINARY DIFFERENTIAL EQUATIONS
A. C. Hindmarsh Jan. 1979 16 p refs Presented at the Am. Nucl. Soc. Natl. Topical Meeting on Computational Methods in Nucl. Eng., Williamsburg, Va., 23-25 Apr. 1979
(Contract W-7405-eng-48)
(UCRL-82091; Conf-790402-5) Avail: NTIS HC A02/MF A01

Two groups of programs were developed, primarily at LLL, for the numerical solution of initial-value problems for systems of ordinary differential equations. The first includes the GEAR package, based on the earlier work of C.W. Gear. It is a general-purpose, variable-step, variable-order, automatic ODE solver, with either different method options, covering both stiff and nonstiff problem types. A number of variants of GEAR were written, largely in order to solve large stiff problems of various types. A newer and smaller group of programs is based on the EPISODE package, which resembles GEAR but is based on totally variable-step formulas. Considerable effort was spent in adapting these ODE solvers to problems arising from time-dependent partial differential equations. DOE

N79-30972# California Univ., Livermore. Lawrence Livermore Lab.
COMPUTER GRAPHICS BY EXAMPLE. PART 6: SHADEIT: HOW TO PRODUCE SHAPED-AREA GRAPHS IN COLOR
K. OHair 30 Oct. 1978 27 p refs
(Contract W-7405-eng-48)
(UCID-30166-Pt-6) Avail: NTIS HC A03/MF A01

SHADEIT constructs professional-quality shaped-area graphs in color for reports and presentations. It offers automatic picture layout. The user can label, texture, or color the graph to identify classes of data. The use of SHADEIT on the CDC 7600 computers of the Livermore Time-Sharing System is described. DOE

N79-30973# California Univ., Livermore. Lawrence Livermore Lab.
CONTx: CONTOURS FROM IRREGULAR DATA POINTS
Kelly OHair 24 Nov. 1978 26 p refs
(Contract W-7405-eng-48)
(UCID-30170) Avail: NTIS HC A03/MF A01

CONTx, presently a set of four interactive programs, accepts random points in 3-space and produces contour maps. It creates a triangular mesh by using the data points as vertices. It then estimates a surface by using this triangular mesh as the basis for the contour map. The x in the name CONTx specifies the maximum number of data points this code can handle. There are presently four programs, CONT150, CONT500, CONT1000, and CONT5000. CONT150, for example, can handle up to 150 x values, 150 y values, and 150 z values. The program that is expected to cover the number of points in the data is the one to be selected. The CONTx programs run on the CDC-7600 computers of the Livermore Time-Sharing System. DOE

N79-30974# Sandia Labs., Albuquerque, N. Mex.
DATA ACQUISITION AND TEST SYSTEM SOFTWARE
Nick A. Bourgeois, Jr. Mar. 1979 45 p refs
(Contract EY-76-C-04-0789)
(SAND-78-1972) Avail: NTIS HC A03/MF A01

Various aspects of perimeter security systems are considered including the development of advanced signal processing techniques to reduce the false and nuisance alarms from sensor systems while improving the probability of intrusion detection. The need existed for both data acquisition hardware and software. Also, the hardware is used to implement and test the signal processing algorithms in real time. The hardware developed for this signal processing task is the Data Acquisition and Test System (DATS). The programs developed for use on DATS are described. The descriptions are taken directly from the documentation included within the source programs themselves. DOE

N79-30975# Saab-Scania, Goteberg (Sweden). Electronics Systems Dept.
STANDARD PROCESSING ROUTINES. VOLUME 1: SUMMARY Final Report
Erik Mattson and Staffan Wilroth Paris ESA Jun. 1978 62 p refs 4 Vol.
(Contract ESTEC-3010/76/NL-HP(SC))
(RA-OBC-5.10-028-Vol-1; ESA-CR(P)-1173-Vol-1) Avail: NTIS HC A04/MF A01

The capabilities of the onboard data handling system concept, with respect to the optimization of execution of experiments carried out in space, were evaluated. Standard processing routines which are applicable to typical categories of experiments were defined. Basic algorithms were selected from a list of appropriate algorithms, considering the usefulness and the feasibility of the method vis a vis the on-board computer used. The selected algorithms were implemented and tested. The report exists as four separate volumes. Volume 1 contains a summary of the work. Volume 2A describes the algorithms which were considered. Volume 2B covers the implementation of the selected algorithms, including comments on hardware modifications in some cases, and Volume 3 gives a detailed account of the test results. Author (ESA)

N79-30976# Saab-Scania, Goteberg (Sweden). Electronics Systems Dept.
STANDARD PROCESSING ROUTINES. VOLUME 2A: ALGORITHM DESCRIPTIONS Final Report
Erik Mattsson and Staffan Wilroth Paris ESA Jun. 1978 293 p refs 4 Vol.
(Contract ESTEC-3010/76/NL-HP(SC))
(RA-OBC-5.10-029-Vol-2A; ESA-CR(P)-1173-Vol-2A) Avail: NTIS HC A13/MF A01

The capabilities of the onboard data handling system concept, with respect to the optimization of execution of experiments carried out in space, were evaluated. Standard processing routines which are applicable to typical categories of experiments were defined. Basic algorithms were selected from a list of appropriate algorithms, considering the usefulness and the feasibility of the method vis a vis the onboard computer used. The selected algorithms were implemented and tested. The report exists as four separate volumes. Volume 1 contains a summary of the

work. Volume 2A describes the algorithms which were considered. Volume 2B covers the implementation of the selected algorithms, including comments on hardware modifications in some cases, and Volume 3 gives a detailed account of the test results.
Author (ESA)

N79-30977# Saab-Scania, Goteberg (Sweden). Electronics Systems Dept.
STANDARD PROCESSING ROUTINES. VOLUME 2B: ALGORITHM LISTINGS Final Report
Paris ESA Jun. 1978 272 p 4 Vol.
(Contract ESTEC-3010/76/NL-HP(SC))
(RA-OBC-5.10-030-Vol-2B; ESA-CR(P)-1173-Vol-2B) Avail: NTIS HC A12/MF A01

The capabilities of the onboard data handling system concept, with respect to the optimization of execution of experiments carried out in space, were evaluated. Standard processing routines which are applicable to typical categories of experiments were defined. Basic algorithms were selected from a list of appropriate algorithms, considering the usefulness and the feasibility of the method vis a vis the on-board computer used. The selected algorithms were implemented and tested. The report exists as four separate volumes. Volume 1 contains a summary of the work. Volume 2A describes the algorithms which were considered. Volume 2B covers the implementation of the selected algorithms, including comments on hardware modifications in some cases, and Volume 3 gives a detailed account of the test results.
Author (ESA)

N79-30978# Saab-Scania, Goteberg (Sweden). Electronics Systems Dept.
STANDARD PROCESSING ROUTINES. VOLUME 3: ALGORITHM TESTING Final Report
Erik Mattson and Staffan Wilroth Paris ESA Jun. 1978 171 p 4 Vol.
(Contract ESTEC-3010/76/NL-HP(SC))
(RA-OBC-5.10-031-Vol-3; ESA-CR(P)-1173-Vol-3) Avail: NTIS HC A08/MF A01

The capabilities of the onboard data handling system concept, with respect to the optimization of execution of experiments carried out in space, were evaluated. Standard processing routines which are applicable to typical categories of experiments were defined. Basic algorithms were selected from a list of appropriate algorithms, considering the usefulness and the feasibility of the method vis a vis the onboard computer used. The selected algorithms were implemented and tested. The report exists as four separate volumes. Volume 1 contains a summary of the work. Volume 2A describes the algorithms which were considered. Volume 2B covers the implementation of the selected algorithms, including comments on hardware modifications in some cases, and Volume 3 gives a detailed account of the test results.
Author (ESA)

N79-30979# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
THE ROBERTSON/WITTENBURG-FORMALISM AND THE PACKAGE MULTIBODY FOR COMPUTER SIMULATIONS OF MULTIBODY SYSTEMS
Richard Schwertassek May 1978 50 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-557)
(DLR-FB-78-08) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 49,70

The prediction of the dynamic behavior of multibody systems (MBS) is based on computer oriented multibody formalisms. The corresponding computer programs prove to be an efficient tool for treating a great variety of problems. Their broad field of application results from consistent use of the capacity of modern computers. The equations of motion are established by the computer itself, starting from input data, which may be derived easily by the user. This report contains the kinematic and dynamic equations of MBS in sealer, computer oriented form based on one of the most developed formalisms, the only by R.E. Roberson and J. Wittenburg. These equations are implemented in the multipurpose computer package MULTIBODY. Its characteristics are demonstrated by considering an example from a typical field of application. The deployment of the solar arrays of a geostationary communication satellite is simulated.
Author (ESA)

N79-30980# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
NONLINEAR PROGRAMMING: PRINCIPLES, TECHNIQUES, EXAMPLES
Dieter Kraft Mar. 1978 111 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-572)
(DLR-FB-77-68) Avail: NTIS HC A06/MF A01; DFVLR, Cologne DM 47,30

Methods of nonlinear programming are compared after a synopsis of necessary and sufficient conditions for optimal solutions. The coherence of the algorithms is emphasized, then their differences (e.g. determination of search direction) are exposed. Some of the most efficient techniques are compared on the basis of two standard test examples taken from the mathematical programming literature. Finally, the computation of optimal control functions for a high performance aircraft by a computer program, in which generalized penalty functions are implemented, is given as for the solution of complex realistic problems. The FORTRAN-implementation of the generalized penalty function algorith is presented in an appendix.
Author (ESA)

62 COMPUTER SYSTEMS

Includes computer networks.

N79-30981# Los Alamos Scientific Lab., N. Mex.
INTEGRATED COMPUTER NETWORK HIGH-SPEED PARALLEL INTERFACE
R. B. Frank Mar. 1979 11 p refs
(Contract W-7405-eng-36)
(LA-7718-MS) Avail: NTIS HC A02/MF A01

The development of a high-speed parallel interface to meet current and future needs for large scale network computing within the integrated computer network is detailed from conceptual through implementation stages.
DOE

N79-30982# Sandia Labs., Albuquerque, N. Mex.
COMPUTER NETWORK SWITCHING METHODS
R. Halbewachs 1979 12 p refs Presented at Rio Grande ACM Winter Meeting, El Paso, Tex., 16 Feb. 1979
(Contract EY-76-C-04-0789)
(SAND-79-0375C; Conf-790217-1) Avail: NTIS HC A02/MF A01

An outline of a talk on computer network switching methods is given. Multiplexing and switching of point-to-point communications is discussed. Various methods of implementation are explained, and aspects of switching methods are compared.
Author (DOE)

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

N79-30983*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LOW-LEVEL PROCESSING FOR REAL-TIME IMAGE ANALYSIS
R. Eskenazi and J. M. Wilf 1 Sep. 1979 16 p refs
(Contract NAS7-100)
(NASA-CR-162107; JPL-Pub-79-79) Avail: NTIS HC A02/MF A01 CSCL 09B

A system that detects object outlines in television images in real time is described. A high-speed pipeline processor transforms the raw image into an edge map and a microprocessor, which is integrated into the system, clusters the edges, and represents them as chain codes. Image statistics, useful for higher

level tasks such as pattern recognition, are computed by the microprocessor. Peak intensity and peak gradient values are extracted within a programmable window and are used for iris and focus control. The algorithms implemented in hardware and the pipeline processor architecture are described. The strategy for partitioning functions in the pipeline was chosen to make the implementation modular. The microprocessor interface allows flexible and adaptive control of the feature extraction process. The software algorithms for clustering edge segments, creating chain codes, and computing image statistics are also discussed. A strategy for real time image analysis that uses this system is given. A.W.H.

N79-30984# Argonne National Lab., Ill. Reactor Analysis and Safety Div.
PROSA-1: A PROBABILISTIC RESPONSE-SURFACE ANALYSIS CODE
J. K. Vaurio, C. Mueller, J. M. Kyser, and D. Sciaudone Jun. 1978 157 p refs
(Contract W-31-109-eng-38)
(ANL-78-56) Avail: NTIS HC A08/MF A01

Techniques for probabilistic response surface analysis were developed to obtain the probability distributions of the consequences of postulated nuclear reactor accidents. The uncertainties of the consequences are caused by the variability of the system and model input parameters used in the accident analysis. Probability distributions are assigned to the input parameters, and parameter values are systematically chosen from these distributions. These input parameters are then in deterministic consequence analyses performed by mechanistic accident-analysis codes. The results of these deterministic consequence analyses are used to generate the coefficients for analytical functions that approximate the consquences in terms of the selected input parameters. These approximating functions are used to generate the probatility distributions of the consequences with random sampling used to obtain values for the accident parameters from their distirbutions. A computer code PROSA was developed for implementing the probabilistic response surface technique. DOE

N79-30985# European Space Agency, Paris (France).
INVESTIGATIONS OF SELF ORGANIZING CONTROL LAWS AND POSSIBILITIES OF THEIR REALIZATION
Hans-Juergen Schnittger Feb. 1979 49 p refs Transl. into ENGLISH of 'Untersuchung von Wirkungsweise und Realisierungsmoeglichkeiten eines 'self-organizing-control'Regelverfahrens', DFVLR, Brunswick Report DLF-FB-77-75, 28 Dec. 1977 Original report in GERMAN previously announced as N78-31833 Original German report available from DFVLR, Cologne DM 24,30
(ESA-TT-519; DLR-FB-77-57) Avail: NTIS HC A03/MF A01

Two control principles that have been proposed in American publications for the control of nonlinear processes and processes with high parameter variation were investigated under theoretical and practical aspects. The first method allows suppression of limit cycles in nonlinear control loops. It is also known as method of statistical linearization. The second one is an optimization procedure based on a search algorithm. The optimization goal is to strike rapidly a switching line in the state plane on which the system behavior is independent of the process parameters. The method makes it possible to observe and counteract sudden changes of the process gain polarity.
Author (ESA)

N79-30258*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Communication Systems Research Section.
A FAST TECHNIQUE FOR COMPUTING SYNDROMES OF BCH AND RS CODES
I. S. Reed (Univ. of Southern Calif.), T. K. Truong, and R. L. Miller *In its* The Deep Space Network 15 Aug. 1979 p 67-70 refs (For primary document see N79-30248 21-12)
Avail: NTIS HC A06/MF A01 CSCL 09B

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N79-30986*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NONLINEAR ORDINARY DIFFERENCE EQUATIONS
Thomas K. Caughey 1 Jun. 1979 118 p refs
(Contract NAS7-100)
(NASA-CR-162106; JPL-Pub-79-50) Avail: NTIS HC A06/MF A01 CSCL 12A

Future space vehicles will be relatively large and flexible, and active control will be necessary to maintain geometrical configuration. While the stresses and strains in these space vehicles are not expected to be excessively large, their cumulative effects will cause significant geometrical nonlinearities to appear in the equations of motion, in addition to the nonlinearities caused by material properties. Since the only effective tool for the analysis of such large complex structures is the digital computer, it will be necessary to gain a better understanding of the nonlinear ordinary difference equations which result from the time discretization of the semidiscrete equations of motion for such structures. Author

N79-30987*# Del Mar Coll., Corpus Christi, Tex.
ON THE SPECTRUM OF INHOMOGENEOUS TURBULENCE
George Trevino 1979 27 p refs
(Grant NsG-1615)
(NASA-CR-162137) Avail: NTIS HC A03/MF A01 CSCL 12A

Inhomogeneous turbulence is defined as turbulence whose statistics are functions of spatial position. The turbulence spectrum, and particularly how the shape of the spectrum varies, from point to point in space, as a consequence of well defined spatial variations in the turbulence intensity and/or integral scale is investigated. A.W.H.

N79-30988# Texas Inst. for Computational Mechanics, Austin.
GALERKIN AND COLLOCATION-GALERKIN METHODS WITH SUPERCONVERGENCE AND OPTIMAL FLUXES
G. F. Carey, D. Humphrey, and M. F. Wheeler Jun. 1979 29 p refs
(Contract N00014-78-C-0550)
(AD-A069867; TR-1; TR-2) Avail: NTIS HC A03/MF A01 CSCL 12/1

Finite element methods are formulated and examined for Galerkin and collocation schemes and a mixed collocation-Galerkin finite element method. Superconvergence at special points is investigated and a new method for calculating optimal derivatives such as fluxes or stresses in typical applications is described and implemented for an example problem. GRA

N79-30989# Illinois Univ. at Urbana-Champaign, Urbana. Applied Computation Theory Group.
A NEW APPROACH TO PLANAR POINT LOCATION
Franco P. Preparata Oct. 1978 29 p refs
(Contract DAAB07-72-C-0259; Grant NSF MSC-76-17321)
(AD-A069833; ACT-11; UILU-ENG-78-22; R-829) Avail: NTIS HC A03/MF A01 CSCL 12/1

Given a planar straight line graph G with n vertices and a point PO, locating PO means to find the region of the planar subdivision induced by G which contains PO. Recently, Lipton and Tarjan presented a brilliant but extremely complex point location algorithm which runs in time O(logn) on a data structure using O(n) storage. This paper presents a practical algorithm which runs in less than 6 (log2n) comparisons on a data structure which uses O(nlogn) storage, in the worst case. The method rests crucially on a simple partition of each edge of G into O(logn) segments. GRA

N79-30990# Wisconsin Univ., Madison. Mathematics Research Center.
ANALYSIS OF FINITE ELEMENT METHODS FOR SECOND ORDER BOUNDARY VALUE PROBLEMS USING MESH DEPENDENT NORMS
I. Babuska and T. Osborn Feb. 1979 23 p refs
(Contract EY-76-S-05-3443)
(ORO-3443-78) Avail: NTIS HC A02/MF A01

A new approach to the analysis of finite-element methods is presented which is based on C finite elements for the approximate solution of second-order boundary-value problems in which error estimates are derived directly in terms of two

mesh-dependent norms that are closely related to the L sub 2 norm and to the second-order Sobolev norm, respectively, and in which there is no assumption of quasi-uniformity on the mesh family. This is in contrast to the usual analysis, in which error estimates are first derived in the first-order Sobolev norm and subsequently are derived in the L sub 2 norm in the second - order Sobolev norm - the second-order Sobolev norm estimates being obtained under the assumption that the functions in the underlying approximating substances lie in the second-order Sobolev space and that the mesh family is quasi-uniform. DOE

N79-30991# Sandia Labs., Albuquerque, N. Mex.
COMPUTATIONAL SOLUTION OF TWO-POINT BOUNDARY-VALUE PROBLEMS
M. R. Scott and H. A. Watts 1979 17 p refs Presented at Computational Methods in Nucl. Eng., Williamsburg, Va., 23 Apr. 1979
(Contract EY-76-C-04-0789)
(SAND-79-0846C; Conf-790402-15) Avail: NTIS HC A02/MF A01

Over the past few years there has been a considerable amount of effort expended towards the development of quality software packages for the computational solution of two-point boundary-value problems. A suite of codes based upon superposition, orthonormalization, and quasilinearization which was developed over the past few years is described. These codes were developed with the user in mind; that is, they are easy to use, reliable, robust, and efficient. DOE

N79-30992# Sandia Labs., Albuquerque, N. Mex.
COMPUTATION WITH SPLINES AND B-SPLINES
D. E. Amos Mar. 1979 49 p refs
(Contract EY-76-C-04-0789)
(SAND-78-1968) Avail: NTIS HC A03/MF A01

Several representations of cubic splines are developed by methods which are generalizable to splines of other degrees. Numerical evaluation is discussed where stable computation can be expected. The FORTRAN B-spline subroutine package is also described with coded examples for evaluation of basis functions, interpolation, and solution of two-point, linear boundary-value problems. Well known results on the convergence of splines to functions in a variety of continuity classes are also discussed. DOE

N79-30993# Los Alamos Scientific Lab., N. Mex.
DIRICHLET INTEGRALS AND A THEORY OF MARGINAL DENSITIES IN SPACES OF DIMENSION N < OR = 2
C. J. Everett and E. D. Cashwell Feb. 1979 17 p refs
(Contract W-7405-eng-36)
(LA-7676-MS) Avail: NTIS HC A02/MF A01

Necessary and sufficient conditions are obtained for a function p(x1) to be the marginal density of some f(r) in the case of odd N, while necessary and weak sufficient conditions are given for even N. The value of a Dirichlet-type integral is derived by a simple induction on N, which avoids the cumbersome transformation to tha N-cube usually employed in such cases. DOE

N79-30994# Sandia Labs., Albuquerque, N. Mex. Applied Mathematics Div.
SOLVING COMPLEX VALUED DIFFERENTIAL SYSTEMS
Herman A. Watts, Melvin R. Scott, and Michael E. Lord Jan. 1979 39 p refs
(Contract EY-76-C-04-0789)
(SAND-78-1501) Avail: NTIS HC A03/MF A01

Boundary value procedures are examined on the basis of superposition principles applied to the associated real system of equations. The usual number of necessary integrations of the homogeneous system can be cut by one-half since the underlying problem is complex. Incorporating these ideas into a computer code utilizing an orthonormalization procedure is also discussed. DOE

N79-30995# Argonne National Lab., Ill.
GENERATION AND VERIFICATION OF FINITE MODELS AND COUNTEREXAMPLES USING AN AUTOMATED THEOREM PROVER ANSWERING TWO OPEN QUESTIONS
S. Winker 1 Feb. 1979 9 p refs Presented at the Workshop on Automated Deduction, Austin, Tex., 1 Feb. 1979
(Contract W-31-109-eng-38)
(CONF-790230-1) Avail: NTIS HC A02/MF A01

Two open questions in ternary Boolean algebras Not. Amer. Math. Soc., 16, No. 4, 654 (June 1969); Bull Amer. Math. Soc., 53, No. 6, 567-572 (June 1947); Proc. Eighth Int. Symp. on Multiple-Valued Logic, pp. 251-256) were answered with the aid of an existing automated theorem-proving program without recourse to any additional programming. The new automated theorem-proving techniques developed in answering the open questions are presented. Essentially the existing theorem prover is used in a nonstandard way to seek and verify small finite models and counterexamples for a first-order axiom system. Exhibiting a model of an axiom system proves it consistent; this facility complements traditional theorem-proving methods which can only prove inconsistency. DOE

N79-30996# Sandia Corp., Albuquerque, N. Mex.
WHAT EVERYONE SOLVING DIFFERENTIAL EQUATIONS NUMERICALLY SHOULD KNOW
L. F. Shampine Mar. 1979 25 p refs
(Contract EY-76-C-04-0789)
(SAND-78-0315) Avail: NTIS HC A02/MF A01

Information is presented for the user of codes for solving ordinary differential equations. Waht is attempted and the implications of the difference are explained with examples. Furthermore, the computational problem is not the same as the mathematical problem. Not understanding the distinction can seriously affect the results. The way codes try to solve equations is outlined in very general terms. Examples are given which illustrate that not all codes are equally effective in their handling of the art of computation and that caution is necessary when interpreting the results of even the best codes. DOE

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N79-30997# North Carolina Univ. at Chapel Hill. Inst. of Statistics.
EXTREMAL AND RELATED PROPERTIES OF STATIONARY PROCESSES, PART 1
M. R. Leadbetter, G. Lindgren, and H. Rootzen May 1979 103 p refs
(Contract N00014-75-C-0809)
(AD-A069561; Mimeo-Ser-1227) Avail: NTIS HC A06/MF A01 CSCL 12/1

This report considers the generalization of classical extreme value theory for independent random variables, to apply to stationary stochastic processes. Part 1 is concerned with stochastic sequences and part 2 will deal with continuous time process. GRA

N79-30998# Stanford Univ., Calif. Dept. of Statistics.
STATISTICS AS A MATHEMATICAL DISCIPLINE
D. V. Lindley 25 Apr. 1979 19 p refs Revision of a Lecture presented at the Australasian Mathematical Convention, Christchurch, New Zealand, 15-19 May 1978
(Contract N00014-76-C-0475; Grant DAAG29-77-G-0031)
(AD-A069480; SU-TR-272; SU-TR-33) Avail: NTIS HC A02/MF A01 CSCL 12/1

It is argued that statistical inference, like other branches of mathematics, should have a structure of axioms and theorems. Such an axiomatic system is described and shown to lead to the likelihood principle. Almost all standard statistical techniques violate that principle. The paper concludes with an example using the Galton-Watson process which demonstrates the power of the principle. GRA

N79-30999# North Carolina Univ. at Chapel Hill. Inst. of Statistics.
A HOELDER CONDITION FOR THE LOCAL TIME OF THE BROWNIAN SHEET
Robert J. Adler Apr. 1979 12 p refs
(Contract N00014-75-C-0809)

(AD-A069622; Mimeo-Ser-1221) Avail: NTIS HC A02/MF A01 CSCL 12/1

L(x,t), x e IR, t e IR(+N) is the local time of a real valued, N-parameter, Brownian sheet. It is shown that if B is any cube lying within the set for some e > 0, and L(x,B) is the increment of the local time over B, then as long as the sides of B are of sufficiently small length L(x,B) is always bounded above e for some finite random variable. This Hoelder result for the local time was previously derived using an inequality of Tran, the proof of which is currently in doubt. The proof given here is effectively self-contained. F.O.S.

N79-31000# Princeton Univ., N. J. Dept. of Statistics.
SIMULTANEOUS POISSON ESTIMATORS FOR A PRIORI HYPOTHESIS ABOUT MEANS
H. Malcom Hudson and Kam-Wah Tsui (Simon Fraser Univ., Canada) Mar. 1979 13 p refs
(Contract N00014-75-C-0453)
(AD-A069531; TR-145-SER-2) Avail: NTIS HC A02/MF A01 CSCL 12/1

Estimators are presented for the simultaneous estimation of p means of Poisson variables with the properties of significant reduction in mean square error of estimation in the region of a pre-specified set of values and, if p = or > 3, safety, in the sense that mean square error is never worse than that of the minimum variance unbiased estimator. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

No abstracts in this category.

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

No abstracts in this category.

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N79-31001# Naval Research Lab., Washington, D. C. Laser Plasma Branch.
PERSPECTIVE ON SELF-GENERATED MAGNETIC FIELDS
J. A. Stamper 27 Oct. 1978 42 p refs
(Contract ES-77-A-01-6021)
(NRL-MR-3872) Avail: NTIS HC A03/MF A01

Self-generated magnetic fields in the megagauss range were recently re-confirmed by Faraday rotation diagnostics of laser plasma coupling. Direct experimental studies utilized both physical probes (coils) and Faraday rotation of a polarized, probing laser beam. (Experimental X-ray studies provided indirect evidence for the fields by requiring thermal transport inhibition in a self-consistent 2D numerical modeling of the laser-plasma interactions.) The rich variety of theoretical studies includes magnetic field effects in ordinary and magnetic resonant absorption. A 3-channel diagnostic system, utilizing Faraday rotation of a Raman-shifted beam, allowed a study of the magnetic field dependence on several experimental conditions, particularly timing and the presence of a preformed plasma. DOE

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N79-31002*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DISPERSION OF SOUND IN A COMBUSTION DUCT BY FUEL DROPLETS AND SOOT PARTICLES
J. H. Miles and D. D. Raftopoulos (Toledo Univ., Ohio) 1979 29 p refs Presented at 98th Meeting of the Acoustical Soc. of Am., Salt Lake City, 26-30 Nov. 1979
(NASA-TM-79236; E-142) Avail: NTIS HC A03/MF A01 CSCL 20A

Dispersion and attenuation of acoustic plane wave disturbances propagating in a ducted combustion system are studied. The dispersion and attenuation are caused by fuel droplet and soot emissions from a jet engine combustor. The attenuation and dispersion are due to heat transfer and mass transfer and viscous drag forces between the emissions and the ambient gas. Theoretical calculations show sound propagation at speeds below the isentropic speed of sound at low frequencies. Experimental results are in good agreement with the theory.
Author

N79-31003# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
NOISE SUPPRESSION IN JET INLETS Annual Report, 1 Feb. 1978 - 31 Jan. 1979
Ben T. Zinn, William I. Meyer, and William A. Bell Feb. 1979 103 p refs
(Contract F49620-77-C-0066; AF Proj. 2307)
(AD-A069787; AFOSR-79-0614TR) Avail: NTIS HC A06/MF A01 CSCL 20/1

This report summarizes the work performed during the second year of an AFOSR sponsored research program that was primarily concerned with the development of an analytical technique for determining the radiated sound field from axisymmetric jet engine inlet configurations. The analytical technique employed is based upon an integral representation of the external (radiation) solutions of the Helmholtz equation which describe the sound fields external to a given body under either no flow or constant velocity flow situations. The integral representation developed during the course of this research program is different from earlier works in the sense that it not only yields the correct (unique) solution for all radiation problems at all frequencies, but that the resulting integral equations contain no strong (i.e., nonintegrable) singularities and therefore can be solved by straight forward numerical techniques. GRA

N79-31004# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.
PHOTOLITHOGRAPHIC TECHNIQUES FOR SURFACE ACOUSTIC WAVE (SAW) DEVICES. VOLUME 3: TECHNICAL AND OPERATIONAL, PART 3 Final Report, 1 Jul. 1975 - 31 Dec. 1978
A. W. Dozier Dec. 1978 102 p refs
(Contract DAAB07-75-C-0044)
(AD-A069683; FR-79-12-40-Vol-3-Pt-3; DELET-TR-75-0044-F-V-B-V-3-P-3) Avail: NTIS HC A06/MF A01 CSCL 09/5

The design, fabrication, and testing of 60 prototype bandpass, trapped delay line and pulse compression SAW filters on both lithium niobate and ST-quartz are discussed as well as problems encountered in the line production of 150 of each type of the device. A.R.H.

N79-31005# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.
PHOTOLITHOGRAPHIC TECHNIQUES FOR SURFACE ACOUSTIC WAVE (SAW) DEVICES. VOLUME 5: QUALITY ASSURANCE PLAN Final Report, 1 Jul. 1975 - 31 Dec. 1978
A. W. Dozier Dec. 1978 45 p refs
(Contract DAAB07-75-C-0044)
(AD-A069684; FR-79-12-40-Vol-5; DELET-TR-75-0044-F-V-5)

Avail: NTIS HC A03/MF A01 CSCL 09/5

The Hughes Aircraft Company Ground Systems Group Quality System is designed to meet and implement the requirements outlined in MIL-Q-9858A, Quality Program Requirements. Procedures described establish effective organizations, programs and practices to assure timely and economic implementation of company quality objectives and attainment of product quality consistent with contractual quality commitments. A description is given of the procedure to be implemented in the Microelectronics Technology (MELT) laboratory for specific application on the surface acoustic wave pulse compression, band-pass and tapped delay line filters. GRA

N79-31006# Naval Underwater Systems Center, New London, Conn.

ROBUST SEQUENTIAL DETECTION OF NARROWBAND ACOUSTIC SIGNALS IN NOISE

Roger F. Dioyer 9 May 1979 18 p refs Presented at the IEEE Intern. Conf. on Acoustics, Speech, and Signal Processing, 2-4 Apr. 1979

(Proj. A-750-28; ZR0000101)

(AD-A069829; NUSC-TD-6065) Avail: NTIS HC A02/MF A01 CSCL 17/1

Given only the outputs from a discrete Fourier transform (DFT) a robust sequential detector (RSD) for weak signals is derived based on m-interval partitioning. A loglikelihood ratio at the output of the DFT is formulated assuming knowledge of a set of quantiles and scores of the unknown and possible changing noise distribution. The quantiles and scores are chosen to minimize the average time to a decision under practical implementation constraints. GRA

N79-31007# Tennessee Univ. Space Inst., Tullahoma.

AN ACOUSTIC SOURCE MODELING TECHNIQUE TO PREDICT THE NEAR SOUND FIELD OF AXISYMMETRIC TURBULENT JETS Final Report, 1 Sep. 1977 - 15 Nov. 1978

J. R. Maus, C. V. Sundaram, L. B. Bates, and M. G. Scott May 1979 77 p refs

(Contract F40600-77-C-0009)

(AD-A069627; AEDC-TR-79-36) Avail: NTIS HC A05/MF A01 CSCL 20/1

The objective of the investigation reported herein was to develop a technique for determining the free, unreflected sound field produced by a jet engine based on sound measurements obtained in an engine test cell. As a first step in this direction, a procedure has been developed for modeling the sound sources in an axisymmetric jet which allows prediction of the near sound field generated by the jet. The procedure involves modeling the sources for each one-third octave frequency band by a combination of uncorrelated elementary sources derived from the multipole expansion. The strengths of the various source components at a particular frequency are determined by a constrained least squares fit to the far field directivity pattern. When the effects of source motion and axial source distribution with frequency are taken into account, the computed sound field agrees reasonably well with data obtained in the near field. The results of the study indicate however, that it will be very difficult to predict the far field sound from acoustic measurements in an engine test cell. GRA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N79-31008# Indiana Univ. at Bloomington. Dept. of Physics.

OPTICAL PUMPING STUDIES OF COLLISIONAL INTERACTIONS Final Scientific Report

F. A. Franz 22 May 1979 23 p

(Grant AF-AFOSR-2652-74; AF Proj. 2301)

(AD-A069749; AFOSR-79-0680TR) Avail: NTIS HC A02/MF A01 CSCL 07/4

A final scientific report is given on a project involving application of optical pumping techniques to studies of atomic collisions. Magnetic depolarization, nuclear spin efforts, collisional selection rules, surface interactions, and studies of sudden and quasi molecular collisions between alkali atoms and noble gas atoms are particularly emphasized. GRA

N79-31009# Harry Diamond Labs., Adelphi, Md.

ANALYSIS OF STIMULATED ELECTRON RADIATION

Josip Soln and Robert L. Williams Mar. 1979 36 p refs

(DA Proj. 1L1-61101-A-91A)

(AD-A069190; HDL-TR-1885) Avail: NTIS HC A03/MF A01 CSCL 20/8

The stimulated radiation resulting from the interaction between electrons and an incident electromagnetic field was numerically analyzed by using theoretical predictions from the formation of partial differential equations with respect to coupling constants. The analysis included calculations of the radiated power, the number of photons per unit frequency, and frequency upshifts as functions of a solid angle for the vacuum and forward and backward Cerenkov branches. The total radiated powers also were evaluated. GRA

N79-31010# Texas Technological Univ., Lubbock.

PICOSECOND RADIATIONLESS TRANSITIONS IN POLYATOMIC MOLECULES Final Report, 1 Sep. 1976 - 30 Aug. 1978

G. Wilse Robinson 10 May 1979 5 p

(Grants DAAG29-76-G-0289; DAAG29-77-G-0028)

(AD-A069399; ARO-14470.1-C) Avail: NTIS HC A02/MF A01 CSCL 20/10

Picosecond laser spectroscopy presents the best experimental methods for studying radiationless transitions in polyatomic molecules, a long time interest of the author and supported mainly by past ARO grants and/or contracts. This final report summarizes some work in picosecond laser spectroscopy, much of it preliminary, carried out during the termination phase of ARO research support. GRA

N79-31011# Quantum Systems, Inc., Albuquerque, N. Mex.

ELECTRON EXCITATION OF ALKALI ATOMS

S. Ormonde Feb. 1979 57 p refs

(Contract EY-76-C-04-0789)

(SAND-78-1503) Avail: NTIS HC A04/MF A01

The development and testing of a synthesized close coupling, effective model potential, ten-channel electron-atom scattering code is discussed. Preliminary calculations of resonance in cross sections for the excitation of excited states of potassium by low energy electrons are described. The main results obtained are: identification of 1S and 1D structures in excitation cross sections below the 5 2S threshold of neutral potassium; indications of additional structures - 1P and 1D between the 5 2S and 5 2D thresholds; and a suggested explanation of anomalously high interstate-electron impact excitation cross sections inferred from experiments on potassium-seeded plasmas. The effective potential model imbedded in the code can be used to simulate any atomic system approximated by a single bound electron outside an ionic core. With minor modifications the code can be adapted to calculations of electron scattering by two-electron systems. DOE

N79-31012# Missouri Univ., St. Louis.

OBSERVATION OF LUMINESCENT SPECTRA IN LOW ENERGY ION-NEUTRAL COLLISIONS Progress Report, 1 Jun. 1978 - 31 May 1979

J. J. Leventhal Feb. 1979 22 p refs

(Contract EY-76-S-02-2718)

(COO-2718-6) Avail: NTIS HC A02/MF A01

Recent experiments on energy transfer processes in atomic and molecular interactions are described. Of particular interest are the results of studies involving energetically excited atoms. Using laser excitation, collisions between excited sodium atoms were found to form both ionic and highly excited neutral products, neither of which is energetically possible unless both reactant atoms are excited. It is shown that energy from the laser beam is stored in sodim atoms and returned to the system in subsequent collisions between excited species. DOE

N79-31013# Arizona Univ., Tucson.

CALCULATIONS ON ISOTOPE SEPARATION BY LASER INDUCED PHOTODISSOCIATION OF POLYATOMIC

MOLECULES Progress Report, 1 Feb. 1977 - 30 Jun. 1978
Willis E. Lamb, Jr. Jul. 1978 29 p
(Contract EN-77-S-02-4294)
(COO-4294-1) Avail: NTIS HC A03/MF A01

The current SF6 potential is determined. The initial approach is described in terms of a pair of Lennard-Jones potential functions with arbitrary coefficients. A method for determining the potential constants is developed. The SF6 spectrum was reproduced by including three-body forces. By specifying certain parameters such as the 1/r to the 6th power F-F constant and the total dissociation energy of the molecule, a satisfactory global potential was obtained. The laser-molecule interaction energy was developed. DOE

N79-31014# Brookhaven National Lab., Upton, N. Y.
SURFACE ANALYSIS TECHNIQUES AND THEIR USE IN POLLUTION DETECTION AND MEASUREMENT
M. N. Varma and J. W. Baum Nov. 1978 27 p refs Presented at Symp. on Assessing the Industrial Hygiene Monitoring Needs for the Coal Conversion and Oil Shale Industries, Upton, N. Y., 5 Nov. 1978
(Contract EY-76-C-02-0016)
(BNL-25206; Conf-781150-3) Avail: NTIS HC A03/MF A01

Surface analysis techniques such as Auger electron spectroscopy (AES), electron spectroscopy for chemical analysis (ESCA), secondary ion mass spectrometry (SIMS), and ion scattering spectrometry (ISS) are reviewed. The advantages and limitations of these methods are compared with bulk analysis techniques such as X-ray fluorescence spectroscopy, atomic absorption and emission spectroscopy, gas chromatography, and neutron activation analysis. Results obtained using ESCA, AES, SIMS, ISS, and X-ray fluorescence analysis from automobile exhaust, laboratory-prepared samples, clean air, and biological samples are discussed. Possible future areas of research using surface techniques are discussed. DOE

N79-31015# Sandia Labs., Albuquerque, N. Mex.
NOVEL MEASUREMENT OF PROTON DISTRIBUTION
E. L. Venturini and P. M. Richards 1979 9 p refs Presented at 10th US/UK Symp. on Neutron Generators, Albuquerque, N. Mex.
(Contract EY-76-C-04-0789)
(SAND-79-0783C; Conf-790518-3) Avail: NTIS HC A02/MF A01

The low temperature electron spin resonance (ESR) spectrum of dilute Er in ScH/sub x/ and YH/sub x/ powders contains distinct signals which are due to the presence of octahedral as well as tetrahedral protons in the vicinity of the Er ions. The occupation probability for the octahedral protons is determined from the ESR signal intensities, and its variation with hydrogen-to-metal ratio x is explained by a lattice gas calculation, yielding information about bulk proton distribution and relative site energies in these materials. DOE

N79-31016# Los Alamos Scientific Lab., N. Mex.
DISPLACEMENT FUNCTIONS FOR DIATOMIC MATERIALS
Don M. Panrkin and C. Alton Coulter 29 Jan. 1979 6 p refs Presented at 1st Topical Meeting on Fusion Reactor Mater., Miami Beach, Fla., 29-31 Jan. 1979
(Contract W-7405-eng-36)
(LA-UR-79-103; Conf-790125-9) Avail: NTIS HC A02/MF A01

The total displacement function n/sub ij/(E) for a number of diatomic materials is calculated where n/sub ij/(E) is defined to be the average number of atoms of type j which are displaced from their sites in a displacement cascade initiated by a PKA of type i and energy E. From the n/sub ij/(E), the fraction n/sub ij/(E) of the displacements produced by a type i PKA with energy E which are of type j can be calculated. Values of the n/sub ij/ for MgO, CaO, Al2O3, and TaO are presented. DOE

N79-31017# Wright State Univ., Dayton, Ohio.
DIRECT DETERMINATION OF ATOM AND RADICAL CONCENTRATIONS IN THERMAL REACTIONS OF HYDROCARBONS AND OTHER GASES Progress Report, 1 Jan. - 31 Dec. 1978
G. B. Skinner, C. C. Chiang, and D. R. Wood Jan. 1979 10 p refs
(Contract EY-76-S-02-2944)
(COO-2944-3) Avail: NTIS HC A02/MF A01

Hydrocarbon oxidation is studied by making measurements of H, O, and OH and other free redicals involved. The empirical calibrations were completed by shock heating mixtures of hexamethyethane in argon at temperatures near 1000 K. These data, combined with the higher temperature D2 N2O Ar data and correlated using mathematical functions based on the time shapes, led to dependable calibration curves for both H and D over a wide temperature range. Atom concentrations of H and D were for mixtures of H2O2Ar, D2O2Ar, CD4Ar, CD4O2Ar, and C3H8 Ar, and absorption measurements made for O2Ar mixtures. DOE

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N79-31018# California Univ., Berkeley. Lawrence Berkeley Lab.
HOW FAST DOES THE MULTIPLICITY OF PARTICLE PRODUCTION IN p-p COLLISIONS REALLY INCREASE WITH PRIMARY ENERGY
E. M. Friedlander Dec. 1978 7 p refs Presented at the Topical Conf. on Cosmic Rays and Particle Phys. above 10 TeV, Newark, Del., 20 Oct. 1978
(Contract W-7405-eng-48)
(LBL-8530; Conf-7810116-2) Avail: NTIS HC A02/MF A01

Multiplicity distributions of particles created in p-p collisions with E/sub lab/ = 50 to 200 GeV are shown to contain at least one Poisson component which becomes dominant at multiplicities k greater than or equal to 1.5 (k). The mean values of both this component and of the (relatively low multiplicity residue) increase like E/sub lab//sup 1/2/; the relative weight of the Poisson component decreases aprroximately like E/sub lab/ to the -0.3 power. If these trends continue beyond the available accelerator energies, the mean multiplicity to approach an E/sub lab//sup 1/2/ law beyond 10 TeV might be expected. DOE

N79-31019# AD-EX, Portola Valley, Calif.
FEASIBILITY OF CREATING A SUPERHIGH ENERGY COLLIDING ELECTRON-POSITRON BEAM FACILITY
V. E. Balakin, G. I. Budker, and A. N. Skrinskii Nov. 1978 24 p refs Transl. into ENGLISH of unidentified Russian report Sponsored by DOE Prepared for Stanford Linear Accelerator Center, Calif.
(SLAC-Trans-186) Avail: NTIS HC A02/MF A01

A method is proposed for obtaining electron-positron colliding beams using two linear accelerators directed toward each other. Feasibility of this arrangement is discussed, and parameters are given for an accelerator at 2 x 100 GeV and 2 x 300 GeV energies. DOE

N79-31020# Los Alamos Scientific Lab., N. Mex.
SECONDARY BEAM LINE PHASE SPACE MEASUREMENT AND MODELING AT LAMPF
R. Floyd 1979 4 p refs Presented at IEEE Particle Accelerator Conf., San Francisco, 12-14 Mar. 1979
(Contract W-7405-eng-36)
(LA-UR-79-749; Conf-790327-49) Avail: NTIS HC A02/MF A01

Hardware and software were developed for precision on line measurement and fitting of secondary beam line phase space parameters. A system consisting of three planes for measuring particle trajectories, in coincidence with a time of light telescope and a range telescope for particle identification, was interfaced to a computer. Software was developed for on line track reconstruction, application of experimental cuts, and fitting of two dimensional phase space ellipses for each particle species. The measured distributions were found to agree well with the

predictions of the Monte Carlo program DECAY TURTLE. The fitted phase space-ellipses are a useful input to optimization routines used to search for superior tunes. Application of this system to the LAMPF Stopped Muon Channel is described. DOE

N79-31021# Los Alamos Scientific Lab., N. Mex.
STUDY OF RELATIVISTIC ELECTRON BEAMS GENERATED BY A FOILLESS DIODE
Michael E. Jones and Lester E. Thode Jan. 1979 14 p refs
(Contract W-7405-eng-36)
(LA-7600-MS) Avail: NTIS HC A02/MF A01

Preliminary results of a numerical and analytical study of foilless diodes are presented. The work produced an electron emission algorithm for the particle-in-cell simulation code CCUBE. Diode performance was studied as a function of applied magnetic field strength and simple geometry changes. Annular electron beams with an energy of 5 MeV appear obtainable with densities exceeding 10 to the 14th power/cu cm. DOE

N79-31022# Argonne National Lab., Ill.
HADRON-HADRON REACTIONS, HIGH MULTIPLICITY
R. Diebold Sep. 1978 58 p refs Presented at 19th Intern. Conf. on High Energy Phys., Tokyo, 23-31 Aug. 1978
(Contract W-31-109-eng-38)
(ANL-HEP-CP-78-44; Conf-780826-27) Avail: NTIS HC A04/MF A01

High energy and high multiplicity hadron reactions, and charm searches are presented. Ultrahigh energy events and exotic phenomena (cosmic rays), the nuclear effects in high energy collision, and related topics are discussed. DOE

N79-31023# Rensselaer Polytechnic Inst., Troy, N. Y. Plasma Dynamics Lab.
COLLECTED ABSTRACTS ON PARTICLE BEAM DIAGNOSTIC SYSTEMS
R. L. Hickok Jan. 1979 19 p refs
(Contract EY-76-S-05-2229)
(COO-2229-55) Avail: NTIS HC A02/MF A01

A compilation of abstracts on work related to particle beam diagnostics for high temperature plasmas are presented. Neutral beam probing, barium ion beams, and heavy ion beams are some of the included particle beam diagnostics systems. DOE

N79-31024# Argonne National Lab., Ill.
HAZARDS FROM RADIOACTIVE WASTE IN PERSPECTIVE
Bernard L. Cohen 27 Feb. 1979 9 p Presented at Symp. on Waste Management and Fuel Cycles 1979, Tucson, Ariz., 28 Feb. 1979
(Contract W-31-109-eng-38)
(CONF-790204-9) Avail: NTIS HC A02/MF A01

The hazards from wastes from a 1000 MW(e) nuclear power plant to these from wastes from a 1000 MW(e) coal fueled power plant are compared. The latter hazards is much greater than the former. The toxicity and carcinogenity of the chemicals prodcued in coal burning ins emphasized. Comparisons are also made with other toxic chemicals and with nautral radioactivity. DOE

N79-31025# Sandia Labs., Albuquerque, N. Mex.
PRELIMINARY SEABED DISPOSAL MODELING STUDIES
H. E. Nuttall Feb. 1979 19 p refs
(Contract EY-76-C-04-0789)
(SAND-78-1651) Avail: NTIS HC A02/MF A01

In order to evaluate the fluid flow, heat transfer, and ion migration rates within a postulated sub-seafloor waste disposal site, preliminary calculations and computer aided simulations were performed. A base case site description was formulated and a representative set of physical parameters were defined. This information was used in an advanced transport computer code to simulate, in detail, site behavior. The simulation studies were divided into an initial short term heat transfer study followed by a long term ion migration simulation. Heat transfer studies show that very high canister surface temperatures were reached within a few days and that a convective flow cell was clearly established; however, its effect was minimal in lowering canister temperatures. The transient convective flow cell strongly influences ion migration rates; however, this effect decreases directly as the heat generation rat of the waste in the canister decays. This mechanism for ion transport becomes unimportant after about 1000 years. DOE

N79-31026# Abcor, Inc., Wilmington, Mass. Walden Div.
A STUDY OF REVERSE OSMOSIS APPLICABILITY TO LIGHT WATER REACTOR RADWASTE PROCESSING
Joseph Markind and Tam VanTran Apr. 1979 147 p refs Sponsored by NUREG
(PB-294947/7; NUREG-CR-0724) Avail: NTIS HC A07/MF A01 CSCL 18G

Reverse osmosis and ultrafiltration can: (1) provide filtration capability without the need of filter aids; (2) minimize the requirements of chemical regeneration and/or disposal of expensive resins; and (3) proconcentrate wastes without requiring major process equipment with large auxiliary heat supplies. The existing experience, both nuclear and appropriate non-nuclear, of the membrane industry as it applies to the processing of reactor radwaste by membrane technology and in particular, reverse osmosis and ultrafiltration was reviewed. Relevant information was collected from both the literature and extensive communications with users and suppliers of membrane equipment. GRA

74 OPTICS

Includes light phenomena.

N79-31027# Raytheon Co., Waltham, Mass. Research Div.
MANUFACTURING METHODS AND TECHNOLOGY PROGRAM ZINC SELENIDE BLANKS FOR WINDOWS AND LENS ELEMENTS Quarterly Progress Report, 1 Nov. 1978 - 31 Jan. 1979
R. N. Donadio and J. F. Connolly Feb. 1979 29 p
(Contract DAAB07-78-C-2038)
(AD-A069340; S-2483; QPR-2) Avail: NTIS HC A03/MF A01 CSCL 20/6

Two full-scale zinc selenide deposits were successfully conducted using the evaporator system. The optical and mechanical quality of the material produced appears to be the equivalent of that made in the reservoir system. GRA

N79-31028# Hughes Research Labs., Malibu, Calif.
GEODESIC LENSES FOR INTEGRATED OPTIC CIRCUITS Final Report, 25 Apr. 1978 - 24 Apr. 1979
B. Chen and O. G. Ramer May 1979 47 p refs
(Contract N00173-78-C-0102)
(AD-A069711) Avail: NTIS HC A03/MF A01 CSCL 20/6

Under this program, we have successfully developed the ultrasonic impact grinding technique for the fabrication of aspherical geodesic lens depressions. The lens radius is 4 mm and the depth is 1.374 mm. 15% of the lens aperture is allocated for a curved rounding at the edge of the depression. The designed focal length is 10.2 mm for an aberration free aperture of 6.8 mm. The technique of ultrasonic impact grinding is proved to be precise, fast and economic. Reproducible results can be easily obtained. The tool wear problem can be neglected if more than two tools are used for grinding the lens. We have demonstrated that depth variation within 7.5 micrometers for 5 depressions can be obtained using two tools. One of the 5 depressions has the exact designed depth. The consistency of the lens depressions can be further improved if a third tool is used. The grinding process is fast using the 200 W Bullen machine. It takes only 45 sec. to grind a 1.4 mm deep, 8 mm diameter depression in LiNbO3 substrate. GRA

N79-31029# Oak Ridge National Lab., Tenn.
OPTICAL DIAGNOSTICS USING A BARIUM ION BEAM FOR SPATIAL RESOLUTION OF PLASMA PARAMETERS
J. A. Cobble and J. C. Glowienka Mar. 1979 24 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6785) Avail: NTIS HC A02/MF A01

Plasma electron excitation of the 6s 2S/sub 1/2/-6p 2P resonance transitions for the singly charged barium ion is proposed as an optical diagnostic for plasmas of thermonuclear interest. Spatial information arises from the intersection of a barium ion beam and the viewing optics. Measurement of relative intensity

during a scan of beam and/or optics provides information for electron density and temperature profiles. Zeeman splitting of the emission lines allows local magnetic field and beta determination. Plasma and beam conditions for which such a tool is useful are given. DOE

N79-31030# Tennessee Univ., Knoxville. Dept. of Engineering Science and Mechanics.
ANALYSIS OF DIAMOND-TURNED REFLECTIVE OPTICS
H. L. Garth (Oak Ridge Y-12 Plant, Tenn.), J. E. Stoneking, and W. J. Dorris 1978 11 p ref Presented at ASME Winter Ann. Meeting Session on Computer Technol. in Fusion Energy Res., San Francisco, 10-15 Dec. 1978
(Contract W-7405-eng-26)
(Y/DA-7926; Conf-781202-40) Avail: NTIS HC A02/MF A01

A single-crystal diamond cutting tool and a turning machine, modified to improve tool-path control, were combined to produce the highly reflective and accurate mirror surfaces needed for the Los Alamos Scientific Laboratory's ANTARES laser fusion experiment. Mirrors with a contour accuracy of 890 nanometers and a surface finish of 89 nanometers, peak to valley, were produced. It would be prohibitively expensive to produce mirrors with these degrees of accuracy by conventional lapping and polishing techniques. DOE

N79-31031# Engins Matra, Velizy (France).
STUDY ON LIGHTWEIGHT MIRRORS FOR SPACE OPTICAL INSTRUMENTS
D. Kaplan, A. Clochet, and A. Peraldi Paris ESA 15 Dec. 1978 205 p refs
(Contract ESTEC-3344/77/NL-PP(SC))
(Rept-60/589) Avail: NTIS HC A10/MF A01

The state of the art of light weight mirror technology is reviewed. Specific existing hardware is described in order to point out that light weight mirrors may greatly differ depending on their intended utilization. A comprehensive examination of mirror materials and substrate technology is included. Mirrors of particular interest to the European Space Agency are singled out and their development discussed. Mirror optical materials properties are studied with emphasis on physical parameters, microdimensional properties, and optical scatter. A relevant bibliography is given with a classification corresponding to the topics studied. Author (ESA)

N79-30257*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Communications Systems Research Section.
CODING FOR OPTICAL CHANNELS WITH PHOTON-COUNTING
R. J. McEliece and L. R. Welch *In its* The Deep Space Network 15 Aug. 1979 p 61-66 refs (For primary document see N79-30248 21-12)
Avail: NTIS HC A06/MF A01 CSCL 20F

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N79-31032 British Library Lending Div., Boston Spa (England).
DENSITY-DEPENDENT LINES OF HYDROGEN-, HELIUM- AND OXYGEN-LIKE IONS IN LABORATORY PLASMA DIAGNOSTICS
A. V. Ninogradov, I. Yu. Skobelev, and E. A. Yukov Dec. 1978 38 p refs Transl. into ENGLISH from Lebedev Inst. of Phys. (Moscow), preprint 121, 1978
(BLL-CTO/1571-(9091.9F); Preprint-121) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.

The relative intensities of some pairs of lines of hydrogen-, helium- and oxygen-like ions are plotted as a function of the plasma electron density. The ranges of plasma parameters in which these dependences can be used for diagnostics purposes are determined. The results of this investigation can be used for diagnostics of a dense plasma (laser plasma, high-power electron beams, exploding wires, plasma focus, etc.) in the electron density range 10 to the 19th power < N sub e < 10 to the 23d power/cu cm. A.R.H.

N79-31033 British Library Lending Div., Boston Spa (England).
INVESTIGATION OF PLASMA ELECTRON CYCLOTRON RADIATION IN THE L-2 STELLARATOR
D. K. Akulina and Yu. V. Kholnov Jan. 1979 15 p refs Transl. into ENGLISH from Fiz. Plazmy (USSR), v. 4, no. 5, Sep. - Oct. 1978 p 1015-1021
(BLL-CTO/1581-(9091.9F)) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.

Plasma radiation at the second harmonic of the cyclotron frequency was investigated in the L-2 stellarator with ohmic plasma heating. At low densities, synchroton runaway electron radiation is observed with a radiative temperature of up to 5 keV. It is also shown that under high density conditions, it is possible to measure the maximum plasma electron temperature. A preliminary analysis of the feasibility of measuring the distribution was made. The two different types of discharge observed are discussed. A.R.H.

N79-31034 British Library Lending Div., Boston Spa (England).
PLASMA ENERGY BALANCE IN THE L-2 STELLARATOR WITH OHMIC HEATING
D. K. Akulina, E. D. Andryukhina, M. S. Berezhetskii, S. E. Grebenschikov, G. S. Voronov, I. S. Sbitnikova, O. I. Fedyanin, Yu. V. Kholnov, and I. S. Shpigel Jan. 1979 20 p refs Transl. into ENGLISH from Fiz. Plazmy (USSR), v. 4, no. 5, Sep. - Oct. 1978 p 1022-1032
(BLL-CTO/1582-(9091.9F)) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.

Experiments were carried out with a longitudinal magnetic field of up to 16 kG, a plasma current of 10 to 20 KA, and an initial hydrogen pressure of (0.4 to 2) x 10 to the minus 4 power Torr. The plasma current was rectangular and its duration was 15 to 20 msec. Topics covered include (1) experimental conditions and discharge characteristics; (2) functional dependences of the plasma parameters ; (3) variation of the plasma density; (4) variation of the ohmic heating current; and (5) plasma parameters as a function of the magnetic field. Experimental results are compared with the calculated dependences of the energy content and the energy lifetime assuming pseudoclassical thermal conductivity. Characteristics of the ohmic heating are discussed. A.R.H.

N79-31035 British Library Lending Div., Boston Spa (England).
DISRUPTION OF THE CURRENT LAYER AND RECONNECTION OF THE MAGNETIC FIELD LINES
S. V. Bulanov and P. V. Sasorov Jan. 1978 22 p refs Transl. into ENGLISH from Fiz. Plasmy (USSR), v. 4, no. 4, 1978 p 746-757
(BLL-CTO/1576-(9091.9F)) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.

An analysis is made of the behavior of finite amplitude perturbations in a collisionless plasma layer. The results obtained decribed the nonlinear stage of the disruptive instability, the decay of the current layer and the annihilation of the magnetic field. G.Y.

N79-31036# Indiana Univ. at Bloomington. Dept. of Chemistry.
HYDRODYNAMIC FLOW PATTERNS AS A SIMPLE AID TO EFFECTIVE ICP TORCH DESIGN
Earl Sexton, Richard N. Savage, and Gary M. Hieftje 30 May 1979 17 p refs
(Contract N00014-76-C-0838; Grant NSF CHE-76-10896)
(AD-A069668; TR-21) Avail: NTIS HC A02/MF A01 CSCL 20/9

A new method is described for simplifying the design and construction of inductively coupled plasma torches. In the method, tap water is directed into the torch's gas inlet tubes and the swirl pattern of the exiting liquid is observed. From this pattern, irregularities in the torch can be readily noted and operating behavior of the plasma can be predicted. GRA

N79-31037# Brookhaven National Lab., Upton, N. Y.
HEAVY ION FUSION DEVELOPMENT PLAN
A. W. Maschke 1978 6 p Presented at the Heavy Ion Fusion

Workshop, Chicago 19 Sep. 1978
(Contract EY-76-C-02-0016)
(BNL-25301; Conf-780979-4) Avail: NTIS HC A02/MF A01

Some general considerations in the fusion development program are given. The various factors are considered that must be determined before heavy ion fusion can be assesed. DOE

N79-31038# Science Applications, Inc., Boulder, Colo. Lab. for Applied Plasma Studies.

VELOCITY FOURIER TRANSFORM SOLUTION OF A MODEL COLLISION OPERATOR

P. J. Catto Feb. 1979 11 p refs
(Contract EY-76-C-03-1018)
(LAPS-14B; SAI-023-79-566-LJ) Avail: NTIS HC A02/MF A01

A model collision operator similar to the one first introduced by Chandrasekar is employed to obtain a kinetic equation for waves in a magnetized plasma that can be solved via a velocity Fourier transform technique. DOE

N79-31039# Argonne National Lab., Ill.

DESIGN CONSTRAINTS FOR rf-DRIVEN STEADY-STATE TOKAMAK REACTORS

D. A. Ehst Feb. 1979 46 p refs
(Contract W-31-109-eng-38)
(ANL/FPP/TM-120) Avail: NTIS HC A03/MF A01

Plasma current density profiles are computed using electron Landau damping of lower hybrid waves launched into model Tokamak density and temperature profiles. The total current and current profile shape are chosen consistent with magnetohydrodynamic equilibrium for a variety of temperature and density distributions and plasma beta values. Surface current equilibria appear attractive and are accessible to waves with n/sub z/ as low as 1.2. By suitably choosing the spectrum location and width it is possible to drive the 9.8 MA current of a 7.0 m reactor with as little as 2.8% of the fusion power recirculated as RF input from the waveguides. DOE

N79-31040# Oak Ridge National Lab., Tenn.

TOKAMAK INSTRUMENTATION AND CONTROLS

W. R. Becraft (G.E. Co., Oak Ridge, Tenn.), E. S. Bettis, W. A. Houlberg, R. J. Onega (Virginia Polytech. Inst. and State Univ.), and R. S. Stone Feb. 1979 69 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6617) Avail: NTIS HC A04/MF A01

Physics implications for controls, computer simulation, and shutdown/aborts are discussed. Transient scenario options for the startup of a Tokamak are developed, and the implications for the control system are discussed. A hybrid computer simulation (analog and digital) of the impurity study experiment (ISX-B) which is now being used for corroborative controls investigations is presented. DOE

N79-31041# SRI International Corp., Menlo Park, Calif.

OPTIMUM PHOTOLYTIC PRODUCTION OF EXCITED STATES AND COLLISIONAL PHENOMENA FOR LASER FUSION APPLICATIONS Final Report

W. K. Bischel and C. K. Rhodes 30 Sep. 1978 54 p refs
(Contract EY-76-C-03-0115)
(SRI-PYU-4685) Avail: NTIS HC A04/MF A01

The use of vibrational excitation of the OCS molecule to significantly modify the UV absorption profile, thereby shifting the peak of the Se (S1) yield curve to longer wavelengths is discussed. DOE

N79-31042# Department of Energy, Washington, D. C. Office of Fusion Energy.

IMPROVING THE TOKAMAK FUSION REACTOR CONCEPT: WORKSHOP SUMMARY

Nov. 1978 17 p refs Workshop held at Germantown, Md., 13-14 Jul. 1978
(CONF-780758-Summ) Avail: NTIS HC A02/MF A01

Attention focused on two particular problem areas: (1) maintainability and complexity, and (2) pulsed vs steady-state operation. A general conclusion was that a variety of conceptual solutions have emerged in these areas and that engineering development would almost surely result in an acceptable and attractive commercial product. A number of specific improvements were identified for detailed design work and/or experimentation. DOE

N79-31043# University of South Florida, Tampa. Dept. of Physics.

RESEARCH ON NONLINEAR PLASMA PHENOMENA AND AN INVESTIGATION OF A TURBULENT HEATING SCHEME Final Report

Norman L. Oleson 19 Jul. 1978 26 p refs
(Contract EY-76-S-05-4338)
(TID-29431) Avail: NTIS HC A03/MF A01

The turbulent heating apparatus (THA) was modified and improved, particularly in the triggering circuitry. This modification permitted the taking of new current, voltage, and plasma resistance data at lower pressures as a function of time. A current probe was used to measure directly the current structure of the THA discharge. Electron temperature estimates were obtained by an indirect method and by use of a diamagnetic loop. Evidence of ion heating in the presence of a spatially varying axial magnetic field was not confirmed. The use of this apparatus to tion of the dissipative trapped electron instability appearing in Tokamaks is discussed. DOE

N79-31044# Science Applications, Inc., Boulder, Colo. Lab. for Applied Plasma Studies.

ANALYTIC EIGENVALUE EQUATIONS FOR COLLISIONLESS DRIFT WANES IN TOKAMAKS

P. J. Catto and K. T. Tsang (ORNL, Tenn.) Feb. 1979 37 p refs
(Contract EY-76-C-03-1018)
(LAPS-13B; SAI-023-79-565-LJ) Avail: NTIS HC A03/MF A01

Recently collisionless drift waves in sheared magnetic fields were shown to be stable. The validity of the analytic model employed in one of these investigations is examined. DOE

N79-31045# Pennsylvania State Univ., University Park.

METHOD OF MEASURING DIRECTED ELECTRON VELOCITIES IN FLOWING PLASMA USING THE INCOHERENT REGIONS OF LASER SCATTERING

Barry A. Jacoby and Thomas M. York Feb. 1979 17 p refs
(Contract EY-76-S-02-4020)
(COO-4020-7; SR-79-1) Avail: NTIS HC A02/MF A01

With the presumption that a shifted Maxwellian velocity distribution adequately describes the electrons in a flowing plasma, the details of a method to measure their directed velocity are described. The system consists of a ruby laser source and two detectors set 180 deg from each other and both set at 90 deg with respect to the incident laser beam. The lowest velocity that can be determined by this method depends on the electron thermal velocity. The application of this diagnostic to the measurement of flow velocities in plasma being lost from the ends of theta-pinch devices is described. DOE

N79-31046# Rensselaer Polytechnic Inst., Troy, N. Y.

ION BEAM PROBE PLASMA DIAGNOSTIC SYSTEM Technical Progress Report, 1 Feb. 1977 - 31 Dec. 1978

R. L. Hickok, W. C. Jennings, J. T. Woo, and K. A. Connor Jan. 1979 33 p
(Contract EY-76-S-02-2229)
(COO-2229-50; RPDL-79-1) Avail: NTIS HC A03/MF A01

The development of particle beam diagonistic techniques for making space and time resolved measurements of magnetically confined plasmas is presented. Work completed completed is described. Reliable operation of the research Tokamak, RENTOR, was established but the population discharge is characterized by a large runaway population producing a strong X-ray flux. An ion beam probe and a Thomson scattering diagnostic system were installed on RENTOR, but no definite results were obtained due to the large noise signal generated by the X-ray flux. The ALICE baseball coil was obtained and is being set up as the ALEX mirror system. It will be used for particle beam diagnostic development in 3 dimensional magnetic well geometry. A heavy neutral beam diagnostic system was designed and is under construction for measuring the space potential in ALEX. Improvements in the focusing properties of ion guns and in the sensitivity of the feedback controlled electrostatic energy analyzers were obtained. DOE

N79-31047# Addis Translations International, Portola Valley, Calif.
INSTABILITY OF A ONE-DIMENSIONAL LANGMUIR WAVE: SOLITONS AND COLLAPSE
N. S. Buchelnikova and E. P. Matochkin Mar. 1979 60 p refs Transl. into ENGLISH of "Neustoichivost Odnomernoi Lengmiurovskoi Volny. Solitony i Kollaps", Rept. Preprint-78-76 Inst. of Nucl. Phys., Novosibirsk, USSR 28 p Sponsored by DOE Prepared for California Univ., Livermore. Lawrence Livermore Lab.
(UCRL-Trans-11469; Preprint-78-76) Avail: NTIS HC A04/MF A01

A numerical experiment is used to study the instability of standing and traveling one-dimensional Langmuir waves over a broad range of parameters: E sub 0 to the 2d power/8 pi nT from 3.10 x ten to the -4th power to 1.6; V/sub phi//V/sub T/ from 16 to 160. It is shown that, throughout the entire range of parameters, modulation instability is observed with modulation length less than or approx. = to the wave length. The instability has no threshold and is observed in all cases, including E sub 0 to the 2d power/8 pi nT much less than (K sub 9 rd) to the 2d power. DOE

N79-31048# Corning Glass Works, N.Y.
LASER FUSION PROJECT Annual Report
W. H. Dumbaugh, D. W. Morgan, and J. E. Flannery 10 Nov. 1978 97 p refs
(Contract EY-76-C-02-4079)
(COO-4079-2; AR-2) Avail: NTIS HC A05/MF A01

Research is devoted to the preparation and characterization of fluoride glasses for laser fusion. The overall objective is to explore and characterize fluoride glass systems to find a glass with the lowest possible nonlinear refractive index, satisfactory chemical durability, and physical properties which enable coating large optical quality pieces. DOE

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N79-31049 British Library Lending Div., Boston Spa (England).
MECHANICAL PROPERTIES AND CLEAVAGE FRACTURE OF IRON SINGLE CRYSTALS AT 77 K
F. Terasaki Mar. 1978 30 p refs Transl. into ENGLISH from FRENCH language article
(BLL-RAE-Lib-Trans-1924-(5207); RAE-Lib-Trans-1924; BR66860) Avail: British Library Lending Div., Boston Spa, Engl.

Tension was applied along (001), (011), and (111) of specimens prepared from aa single crystal of good quality iron that were fractured at the temperature of liquid nitrogen. Specimens tested along (001) showed, after twinning, cleavage fracture. Those tested along (111) deformed first by twinning and then by slip, and broke by cleavage after marked necking. For those tested along (011), after twinning the specimen deformed by slip, as in the case of (111), but with considerable homogeneous extension before the necking. After necking, cleavage cracks were noticed always in a plane parallel to the axis of the tension but the specimen then failed in a ductile manner. Within the limits of the tests, no influence was traced between crystallographic orientation and the critical stress for twinning and flow. A.R.H.

N79-31050 Indiana Univ., Bloomington.
AN INVESTIGATION OF THE LATTICE DYNAMICS AND THE ELECTRON-PHONON INTERACTION IN INDIUM Ph.D. Thesis
David Gerald Garrett 1979 86 p
Avail: Univ. Microfilms Order No. 7916948

By using phonon model, along with the Fermi surface produced by the Ashcroft and Lawrence local pseudopotential, and an electron-phonon interaction model based on the optimized model potential of Shaw, the electron-phonon mass enhancement was calculated as a function of position on the Fermi surface. The Fermi surface mass enhancement was also calculated. It is found that the experimentally observed anisotropy in the cyclotron mass is quantitatively reproduced. Further, the isotropic tunneling data are also predicted by the calculation. Simplification of the model such as using single plane-wave electron wave functions and/or a free electron Fermi surface do not lead to agreement with experiment. Dissert. Abstr.

N79-31051*# California Inst. of Tech., Pasadena. Seismological Lab.
RELEASE ADIABAT MEASUREMENTS ON MINERALS: THE EFFECT OF VISCOSITY
Raymond Jeanloz and Thomas J. Ahrens 16 Aug. 1979 18 p refs
(Grant NGL-05-002-105)
(NASA-CR-162143) Avail: NTIS HC A02/MF A01 CSCL 20L

The current inversion of pressure-particle velocity data for release from a high pressure shock state to a pressure-density path is analyzed. It is assumed that the release process is isentropic. It was shown that for geological materials below stresses of 150 GPa, the effective viscosity must be < 1000 kg/m/s in order that the viscous (irreversible) work carried out on the material in the shock state remains small compared to the mechanical work recovered upon adiabatic rarefaction. The available data pertaining to the offset of the Rayleigh line from the Hugoniot for minerals, the magnitude of the shear stress in the high pressure shock state for minerals, and the direct measurements of the viscosisits of several engineering materials shocked to pressures below 150 GPa yield effective viscosities of 1000 kg/m/s or less. An inferance that this indicates that the conditions for isentropic release of minerals from shock states are achieved, and a conclusion that the application of the Riemann integral to obtain pressure-density states along the release adiabats of minerals in shock experiments is valid are made. A.W.H.

N79-31052# Illinois Univ. at Urbana-Champaign. Coordinated Science Lab.
ATOMIC AND ELECTRICAL PROFILE STUDIES OF ION-IMPLANTED SEMICONDUCTORS Ph.D. Thesis
Gerald Twiggs Marcyk Dec. 1978 127 p refs
(Contracts DAAB07-72-C-0259; DAAG29-78-C-0016; N00014-76-C-0806; Grant NSF DMR-77-22228)
(AD-A069782; R-835; UILU-ENG-78-2228) Avail: NTIS HC A07/MF A01 CSCL 20/12

The distribution of ion-implanted impurities in semiconductors was studied using atomic and electrical profiling techniques. The atomic profiles were obtained by Glow Discharge Optical Spectroscopy (GDOS). The GDOS technique, experimental system, and elemental sensitivity are discusssed in detail. The impurity distributions of arsenic-implanted silicon and germanium-implanted gallium arsenide are investigated. High dose arsenic implants in silicon exhibit a concentration-dependent diffusion at high temperatures which leads to a dramatic redistribution from the original implanted profile. The Ge implanted into GaAs shows very little diffusion even for high concentrations annealed at 900 C. The diffusion coefficient of Ge in GaAs is estimated to be 6 times 10 to the -15th power sq cm/sec. at 900 C. The electrical profiles were obtained using Hall measurements in conjunction with successive layer removal. The carrier profiles for As in Si were in substantial agreement with the atomic distributions. The carriers have a concentration limit of about 2 times 10 to the 20th power/cu cm and excellent electrical activation can be obtained for 1000 C anneals. GRA

N79-31053# Oklahoma State Univ., Stillwater. Dept. of Physics.
A STUDY OF DEFECTS PRODUCED BY THE IRRADIATION OF QUARTZ Interim Report, 15 May 1977 - 15 May 1978
Larry E. Halliburton, Joel J. Martin, and William A. Sibley Griffiss AFB, N. Y. RADC Mar. 1978 56 p refs
(Contract F19628-77-C-0171; AF Proj. 2306)
(AD-A069559; RADC-TR-79-33) Avail: NTIS HC A04/MF A01 CSCL 20/13

We have developed and tested a system for measuring the acoustic loss in 5 MHz fifth overtone AT cut resonators by the logarithmic decrement method. The acoustic loss of a Sawyer

swept Electronic Grade sample has been measured from 5 to 300 K in the as received condition and after two room temperature irradiations. The irradiation shifted the low temperature loss peak to a lower temperature, introduced new loss peaks at 100 K and 125 K and removed a large peak at 240 K that was present before irradiation. We have set up a sweeping system to electrolyze quartz. Our current studies involve sweeping in an atmosphere of gettered Ar. Several runs have also been carried out in the presence of H2. We have used low temperature (liquid He and liquid N2) infrared absorption scans to investigate the effects of our sweeping on Sawyer Electronic Grade and Premium Q material. Our results are in general agreement with those reported by the RADC group. The oscillator strength for the OH bands has been estimated and used to determine the H(+) content of Electronic Grade and Premium Q material. GRA

N79-31054# Louisiana State Univ., Baton Rouge. Dept. of Physics and Astronomy.
FORMATION AND MIGRATION ENERGIES OF VACANCIES AND INTERSTITIAL DEFECTS IN ALUMINUM Final Report, 1 May 1972 - 31 Mar. 1979
Joseph Callaway and S. P. Singhal May 1979 14 p refs
(Grants DAHC04-74-G-0173; DAHC04-75-G-0118; Grants DA-ARO(D)-31-124-72-G165; DA-ARO(D)-31-24-73-G133; DAAG29-77-G-0096; DAAG29-78-G-0104)
(AD-A069621; ARO-12287.3-P; ARO-1910588.2-MC; ARO-13228.8-P; ARO-16046.1-P) Avail: NTIS HC A02/MF A01 CSCL 11/6

This report summarizes the accomplishments of the work concerning vacancies in aluminum. A program of theoretical calculations was conceived and carried out. Mathematical details are contained in the several publications that have resulted from this work. This account is intended to enable the reader to place the work in general perspective. A list of the publications which can be consulted for more specific information is included at the end of this narrative. GRA

N79-31055# Army Armament Research and Development Command, Watervliet, N. Y. Large Caliber Weapon Systems Lab.
DIAMAGNETIC ANOMALY IN PRESSURE QUENCHED CdS
C. G. Homan and D. P. Kendall May 1979 22 p refs Presented at the Meeting of Am. Phys. Soc., Chicago, 19-23 Mar. 1979
(DA Proj. 1L1-161102-H-60)
(AD-A069609; AD-E440027; ARLCB-TR-79004) Avail: NTIS HC A02/MF A01 CSCL 20/12

Compacted powder samples of CdS, pressure quenched at approximately 1,000,000 bars/sec at room temperature from pressure above the semiconducting to conducting transition pressure (about 40 kilobars) exhibit an ac diamagnetic anomaly and an increase in electrical conductivity in the diamagnetic state at temperatures near 150 K. These samples, as well as samples pressure quenched from lower pressures but above 10 kbars reveal a layered structure consisting of amorphous platelets in a compact powder matrix. Other changes in the physical properties of these samples are reported. GRA

N79-31056# Illinois Univ. at Urbana-Champaign.
UPPER CRITICAL MAGNETIC FIELD OF SUPERCONDUCTING FILMS WITH MAGNETIC IMPURITIES Ph.D. Thesis
Thomas Richard Lemberger 5 Jul. 1978 164 p refs
(Contract EY-76-C-02-1198)
(COO-1198-1213) Avail: NTIS HC A08/MF A01

H/sub c2/ was determined on In-Mn and Pb-Mn alloys from the resistance of the films. The results were compared with the theory of Fulde and Maki. It was concluded from the Pb-Mn data that the pair-breaking effect of the magnetic impurities is temperature independent, and that the pair-breaking effects of the magnetic impurities and the applied magnetic field are additive. For some of the Pb-Mn alloy films, there was a region of positive curvature in H/sub c2(T) near the zero-field transition temperature. DOE

N79-31057# Oklahoma State Univ., Stillwater.
ELECTRONIC STRUCTURE OF DEFECTS IN OXIDES
1978 15 p refs
(Contract EY-76-S-05-4837)
(ORO-4837-5) Avail: NTIS HC A02/MF A01

Single crystal samples of alpha-Al2O3 studied were colored during growth. The samples initially contained a single absorption band at 6.1 eV with a half-width of 0.68 eV. The spectral dependence of the photoresponse and the excitation spectrum of the 3.0 eV band were similar to the 6.1 eV absorption. After bleaching, an emission band at 3.8 eV was produced, which was similar to a band produced in particle irradiated material. The lifetime of the 3.8 eV emission was less than 50 ns, and the excitation spectrum contained peaks at 4.8 eV and 5.4 eV with a small shoulder at 5.9 eV. An absorption band at 5.2 eV can be introduced into MgAl2O4 by incident electrons or neutrons. The 5.2 eV band can be optically bleached at 40 K. Edge lunimescence at 5.02 eV has been produced in SrO using electron or ultraviolet light excitation. The excitation spectrum of the emission has a threshold at 5.3 eV which is the same as for the production of free charge. DOE

N79-31058# Virginia Univ., Charlottesville. Dept. of Physics.
ELECTRONIC PROPERTIES OF METALS, ALLOYS AND MOLECULES Final Report
Robert V. Coleman 29 Nov. 1978 26 p refs
(Contract EY-76-S-05-3105)
(ORO-3105-61) Avail: NTIS HC A03/MF A01

Electronic transport in metals and alloys and electron tunneling used to study superconductivity, magnetic properties and the spectroscopy of surface absorbed molecules are reported. Author (DOE)

N79-31059# Ames Lab., Iowa.
UTILIZATION OF NMR IN DETERMINATION OF HYDROGEN STRUCTURE IN SOLIDS
R. G. Barnes 1979 15 p refs Presented at the Workshop on Anal. of Hydrogen in Solids, Albuquerque, N. Mex., 23 Jan. 1979
(IS-M-183; Conf-790127-4) Avail: NTIS HC A02/MF A01

Steady-state (wide-line) measurement was applied to study the nuclear magnetic resonance (NMR) of all three hydrogen isotopes. In addition to structural aspects, NMR measurements provided information pertaining to electronic structure and hydrogen diffusion in metal-hydrogen systems. These methods yield parameters characterizing the steady-state interactions of nuclei with their environment. DOE

N79-31060# Illinois Univ., Urbana.
STUDIES IN THE ELECTRONIC STRUCTURE OF MATTER Ph.D. Thesis
D. L. Miller 1979 215 p refs
(Contract EY-76-C-02-1198)
(COO-1198-1246) Avail: NTIS HC A10/MF A01

KLL Auger transition rates for helium are computed using simple atomic orbital wavefunctions which take into account the difference in average electron-electron repulsion of initial and final states. The results are consistent with transition rates computed by other authors using a variety of many-electron techniques. A method for extracting atomic pseudopotentials from photoelectron angular distributions is described and applied photoionization of the outermost p shells of Ar, Kr, and Xe and to the 4d shell of Xe. The extended Hueckel theory is applied to the nitrogen trap in GaAs and GaP. Perfect crystal band structures are computed. Nitrogen impurity levels in GaAs and GaP are computed using an extended Hueckel cluster model. DOE

N79-31061# Hanford Engineering Development Lab., Richland, Wash.
EXPERIMENTAL METHOD TO DETERMINE THE ROLE OF HELIUM IN NEUTRON-INDUCED MICROSTRUCTURAL EVOLUTION
D. S. Gelles and F. A. Garner Dec. 1978 6 p refs Presented at the 1st Topical Meeting on Fusion Reactor Mater., Miami Beach, Fla., 29 Jan. 1979
(Contract EY-76-C-14-2170)
(HEDL-SA-1610; Conf-790125-42) Avail: NTIS HC A02/MF A01

A method is presented which allows the determination of the role of helium on microstructural evolution in complex alloys and which avoids many of the problems associated with other

simulation experiments. It involves a direct comparison of the materials' response to a primary difference in fission and fusion environments, namely the rate of helium generation. This is accomplished by irradiating specimens in a fission reactor and conducting microstructural analyses which concentrate on alloy matrix regions adjacent to precipitates rich in boron or nitrogen. Procedures are outlined for calculation of background and injected helium levels as well as displacement doses generated by neutrons and alpha particles. An example of the analysis method is shown for an experimental austenitic stainless steel containing boride particles and irradiated to 3 and 7 x 10 to the 22d power n/sq cm (e > 0.1 MeV). DOE

N79-31062# Ames Lab., Iowa.
ELECTRONIC STRUCTURE OF TRIVALENT METAL DIHYDRIDES: THEORY
D. J. Peterman, B. N. Harmon, D. L. Johnson, and J. Marchiando 1979 16 p refs Presented at the Hydrogen in Metals Intern. Meeting, Munster, West Ger., 6 Mar. 1979
(Contract W-7405-eng-82)
(IS-M-172; Conf-790301) Avail: NTIS HC A02/MF A01

Self consistent energy bands were calculated for stoichiometric ScH2 and YH2 using the KKR method with the Hedin-Lundqvist approximation for exchange and correlation. The partial hydrogen occupation of octahedral sites in YH2 led to low energy interband transitions, Non muffin-tin corrections were included in an additional self consistent calculation of ScH2. Comparisons are made with various calculation schemes and with optical results. Including an interstitial sphere at the octahedral site leads to excellent agreement with these optical experiments. A nonself-consistent calculation of YH2 with 21 octa and 1 tetrahedral site occupied in presented and mechanisms for the low energy interband transitions are discussed. DOE

N79-31063# Thomson-CSF, Paris (France). Lab. Central de Recherches.
HETERO EPITAXY OF GERMANIUM ON GALLIUM ARSENIDE [HETEROEPITAXIE DE GERMANIUM SUR ARSENIDE DE GALLIUM]
Daniel Delagebeaudeuf, D. V. Bui, M. Lescroel, and M. Colombier Dec. 1977 144 p refs In FRENCH Sponsored in part by Dir. des Rech., Etudes et Tech. (DRET)
(Contract DRME-76/34-395)
(LCR-90-213) Avail: NTIS HC A07/MF A01

An attempt was made to develop techniques for growing and characterizing epitaxial layers of germanium on a subsrate of gallium arsenide. These crystals were to be used in the development of new hyperfrequency components. The layers, even after elaboration by cracking of the germanium and in spite of their crystallographic qualities, were too doped to be of use. Nonetheless, technological advances in crystal growth were obtained. Techniques for mixing in situ germanium with purified hydrigen as well as for preparing the substrate by anodic oxidation and deoxidation were developed. A technique for preventing the exodiffusion of the substrate by anodic oxide envelopment was also perfected. Author (ESA)

N79-31064# Erlangen-Nuremberg Univ. (West Germany). Inst. fuer Werkstoffwissenschaften.
CRYSTAL GROWTH OF 3-5 SEMICONDUCTORS: IMPROVEMENT QUALITY UNDER ZERO-g CONDITIONS Final Report
Klaus-Werner Benz, Herbert Weiss, and Georg Muller Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1977 72 p refs In GERMAN; ENGLISH summary Prepared in cooperation with Stuttgart Univ. Report will also be announced as translation (ESA-TT-577)
(Contracts BMFT-WRT-1075; DFVLR-BPT-01-QV-385A)
(BMFT-FB-W-77-33) Avail: NTIS HC A04/MF A01; ZLDI, Munich DM 14,70

A traveling solvent method of crystal growth was studied and the crystals obtained characterized in order to determine a basis for evaluating crystal growth experiments to be conducted in Spacelab. Gallium antimonide (GaSb) and indium antimonide (InSb) crystals were grown using a vertical system (GaSb + InSb) as well as a horizontal one (InSb). A comparison was made between growth rates calculated by a diffusion limited transport model and the growth rates of the experiments. From these results it is concluded that the transport mechanism in the solution is governed by convection. The influence of various growth parameters on the crystal quality was studied. GaSb single crystals were grown with a diameter of 10 mm and the length of 30 mm. The dislocation density of these growth crystals was lower by a reactor of 100, compared with the dislocation density of the seed crystal. Author (ESA)

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

No abstracts in this category.

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N79-31065 Pittsburgh Univ., Pa.
A CONTINGENCY MODEL OF ASSESSMENT OF IMPACT OF FLEXI-TIME INSTALLATION Ph.D. Thesis
Vadake Kurupath Narayanan 1978 205 p
Avail: Univ. Microfilms Order No. 7917404

A field experiment was designed to assess the impact of flexi-time installation, in a large division of a multinational corporation. At the individual level, moderating effects were hypothesized on flexibility, work climate and productivity due to (1) environmental factors--car pool membership and distance from work; (2) hierarchic level; and (3) socio-technical variables-back up, degree of cross-training, job satisfaction and social belongingness. The results strongly support moderating effects due to hierarchic level, social belonging and job satisfaction. At the organizational level, absenteeism decreased while productivity did not change. It is proposed that future research in organizational change should include influences due to moderating variables. Dissert. Abstr.

N79-31066*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DATA BASE MANAGEMENT SYSTEMS PANEL WORKSHOP: EXECUTIVE SUMMARY
1 Aug. 1979 18 p Workshop held at Pasadena, Calif., 5-7 Mar. 1979
(Contract NAS7-100)
(NASA-CR-162105; JPL-Pub-79-70) Avail: NTIS HC A02/MF A01 CSCL 05A

Data base management systems (DBMS) for space acquired and associated data are discussed. The full range of DBMS needs is covered including acquiring, managing, storing, archiving, accessing and dissemination of data for an application. Existing bottlenecks in DBMS operations, expected developments in the field of remote sensing, communications, and computer science are discussed, and an overview of existing conditions and expected problems is presented. The requirements for a proposed spatial information system and characteristics of a comprehensive

browse facility for earth observations applications are included.
A.W.H.

N79-31067# Decision Focus, Inc., Palo Alto, Calif.
RESOURCE-ALLOCATION METHODOLOGY FOR ESTABLISHING RD AND D BUDGETARY PRIORITIES
D. W. Boyd, D. W. North, and S. G. Regulinski Feb. 1978 178 p refs
(Contract ET-78-C-05-5474)
(ORO-5474-T1) Avail: NTIS HC A09/MF A01

The R, D and D resource-allocation methodology is designed for use by the Assistant Secretary, Energy Technology, in establishing budgetary priorities. It defines a logical process for developing a portfolio of programs consistent with policy goals of the Assistant Secretary, the complexities of the energy marketplace, and the departmental resource constraints. The methodology has two important components: a set of analytic procedures and a process for communicating information. Both of these aspects are necessary if the methodology is to be successfully implemented. Thus, it is the combination of these two aspects that provides the logical decision process that can cope with the complexities of choosing a portfolio of programs.
DOE

N79-31068# Environmental Research Center, Cincinnati, Ohio.
HANDBOOK FOR PREPARING OFFICE OF RESEARCH AND DEVELOPMENT REPORTS
Dec. 1978 40 p Revised
(PB-294363/7; EPA-600/9-78-032) Avail: NTIS HC A03/MF A01 CSCL 05B

The essential specifications set forth by the Office of Research and Development (ORD) to ensure that the results and conclusions of its various research, development, and demonstration programs are documented and printed in a uniform, high quality, and cost-effective manner. It is specifically intended to assist those individuals responsible for preparing ORD scientific and technical reports by providing consistent format specifications and guidelines for the actual preparation of camera-ready reports. GRA

N79-31069# Marley Organization, Inc., Ridgefield, Conn.
PRINCIPAL ASPECTS OF US LABORATORY ACCREDITATION PROGRAMS
Charles W. Hyer 24 Jan. 1979 73 p
(Contract C-8-16656)
(PB-293463/6) Avail: NTIS HC A04/MF A01 CSCL 05A

The summaries covered in the areas of Federal government, state and local government, and professional and trade associations, include 56 programs. Information covered includes date established, type and scope of the program, authority for the program, funding and fees, fields of testing, standards and accreditation criteria employed, frequency and extent of laboratory assessment, appeal procedures, extent of proficiency testing required, the number of laboratories in the program, and the extent of international recognition. For each program a person has been identified who can process an application or is in other ways knowledgeable about the nature and content of the program. GRA

N79-31070# Commerce Dept., Washington, D.C. Office of Product Standards.
SUMMARY OF PROCEEDINGS, 2ND INTERNATIONAL CONFERENCE ON RECOGNITION OF NATIONAL PROGRAMS FOR ACCREDITATION TESTING LABORATORIES, ILAC/78
Oct. 1978 25 p Conf. held at Washington, D. C., 23-27 Oct. 1978
(PB-294269/6) Avail: NTIS HC A02/MF A01 CSCL 14B

The presentations made at the Conference and the actions taken by the Conference are briefly summarized. The Task Force 1 report covered the relationships between ILAC and ISO certification problems. The Task Force 2 report covered the legal problems which may affect parcipitation by nations in any international arrangement for reciprocal recognition of national accreditation programs or schemes. The Task Force 3 report covered a proposed international directory of laboratory accrediting organizations. The Conference acknowledged the work of these Task Forces and created three new Task Forces to extend their work. GRA

N79-31071# Moshman Associates, Inc., Bethesda, Md.
FEDERALLY FUNDED RESEARCH AND DEVELOPMENT AT UNIVERSITIES AND COLLEGES: A DISTRIBUTIONAL ANALYSIS, VOLUME 1 Final Report
George J. Nozicka Feb. 1979 175 p refs 2 Vol.
(Grant NSF SRS-77-20867)
(PB-294008/8) Avail: NTIS HC A08/MF A01 CSCL 05A

Universities with doctoral programs in the sciences and engineering are heavily concentrated with the top quartile of schools accounting for three-quarters of all federally funded R&D expenditures. The distribution of non-Federal funds closely parallels the Federal distribution. No significant difference was found in the distribution of both Federal and non-Federal funds, between fields considered to be capital intensive and those not considered to be so. The distributional patterns of NSF research grant proposals were also analyzed and show that the concentration patterns of Federal support for academic R&D activities reflects the existing stratification of the research system in academia.
GRA

N79-31072# Moshman Associates, Inc., Bethesda, Md.
FEDERALLY FUNDED RESEARCH AND DEVELOPMENT AT UNIVERSITIES AND COLLEGES: A DISTRIBUTIONAL ANALYSIS. VOLUME 2: APPENDICES Final Report
George J. Nozicka Feb. 1979 76 p 2 Vol.
(Grant NSF SRS-77-20867)
(PB-294009/6) Avail: NTIS HC A05/MF A01 CSCL 05A

Tables which contain the data used to establish the analytical findings are presented. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software.*

N79-31073# Martin Marietta Aerospace, Denver, Colo.
MODELING A LARGE SCALE DATA BASE Final Report
T. W. Connolly Griffiss AFB, N. Y. RADC Apr. 1979 65 p refs
(Contract F30602-77-C-0142; AF Proj. 4594)
(AD-A069470; MCR-78-1405; RADC-TR-79-47) Avail: NTIS HC A04/MF A01 CSCL 09/2

This document reports the methods and results of a study of a large database through use of modeling concepts and simulation software. The simulation software had been developed using the concepts of the four level structure of the Data-Independent Accessing Model (DIAM) and the nomenclature and concepts of the Relational Model. The study was undertaken to assess the feasibility of applying these concepts to modeling a large existing database--in this case, the USAF's PACER database--and to demonstrate the use of existing components of query compiler software used to implement the concepts. The report describes a model of the information content of a subset of the PACER database; the model is expressed as n-ary relations. In a subsequent phase of the study, the investigators developed a model of the access paths in the PACER system. The model uses the 'strings' of the DIAM descriptive technique. Based on analysis of the results, the author concludes that DIAM concepts enhanced by Relational Model nomenclature can serve well as the basis for study of large databases and that prototype software correctly compiles all paths applicable to an input query. GRA

N79-31074# Illinois Univ. at Urbana-Champaign. Coordinated Science Lab.
AN ANALYSIS OF STORAGE, RETRIEVAL, AND UPDATE COSTS FOR DATA BASES WHICH ARE TABLES OF ENTRIES M.S. Thesis
Mark Kenneth Warner Jun. 1978 63 p refs
(Contract DAAB07-72-C-0259; Grant NSF ENG-75-20864)
(AD-A069763; R-816; UILU-ENG-78-2209) Avail: NTIS HC A04/MF A01 CSCL 05/2

The performance of retrieval systems for tables of entries is investigated. The system costs considered are the cost of storing a representation of a table, the cost of retrieving an individual table entry, and the cost of updating the table by adding or deleting the last entry. Several systems are presented and their costs are analyzed. For each type of cost a lower bound is derived, though in some cases it is for a restricted situation (such as for bounded table size). It is found for the problem presented that the actual storage cost and the lower bound on storage cost are both on the order of $lw+1g(l)$, where l is the number of entries in the table and w is the entry size. The bounds on both retrieval cost and update cost are found to be on the order of w, while the actual costs of the best systems presented are on the order of $w+1g(l)$. GRA

N79-31075# Naval Intelligence Processing System Support Activity, Alexandria, Va.
INTEGRATED DATABASE DEVELOPMENT AND DESIGN GUIDE, VERSION 2.0
May 1979 586 p refs
(AD-A069868; NIPSSA-UM-8000/2.0-5/79) Avail: NTIS HC A25/MF A01 CSCL 09/2

The NIPSSA Integrated Database Development and Design Guide is the result of several years of experience developing integrated database applications. It brings together into a structured methodology techniques which have survived trial by implementation. Some of the procedures within the Guide are relatively new and may require additional clarification. The Development of an integrated database is an expensive and highly detailed project. The speed with which applications can be added or enhanced is directly proportional to the analysis resources available. The most time-consuming part of the analysis is the definition of the data elements and their relationships. Once this is done the remainder of the design effort falls rapidly into place. The Guide provides a step-by-step set of instructions which lead to a subsystem implementation of the user's desired application. At the same time it will permit the user, who knows more about the data than anyone else, to perform the initial phases of the analysis. The Guide is meant to provide the complete picture and steps required to implement a database application. For this reason, all of the procedures to be followed by both user and Data Administration (DA) personnel are included. GRA

N79-31076# Sandia Labs., Albuquerque, N. Mex.
ABBREVIATIONS FOR TECHNICAL WRITERS
L. S. Lopez Feb. 1979 63 p
(Contract EY-76-C-04-0789)
(SAND-78-1341-Rev) Avail: NTIS HC A04/MF A01

A comprehensive list of abbreviations likely to be encountered by technical writers is given. It was prepared primarily for use by wirters at Sandia Laboratories, Albuquerque. Author (DOE)

N79-31077# National Technical Information Service, Springfield, Va.
USER NEEDS IN DOCUMENTATION AND INFORMATION. VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1977 - Apr. 1979
Mary E. Young May 1979 171 p Supersedes NTIS/PS-78/0431, NTIS/PS-77/0431; NTIS/PS-76/0325 and NTIS/PS-75/189
(NTIS/PS-79/0407/1; NTIS/PS-78/0431; NTIS/PS-77/0431; NTIS/PS-76/0325; NTIS/PS-75/189) Avail: NTIS HC $28.00/MF $28.00 CSCL 05B

Reports on meeting the needs of the information sciences user in the most direct and specific way are cited, including methods used to determine those needs and measures taken to fulfill them in application to educational resources, data bases, data management, library networks, photographic recording systems, technical information centers, and consulting services. GRA

N79-31078# Metrics, Inc., Atlanta, Ga.
A STUDY OF THE PERCEIVED BENEFITS OF INFORMATION ANALYSIS CENTER SERVICES Final Report
Robert M. Mason Mar. 1979 134 p refs
(Grant NSF DSI-77-18035)
(PB-294719/0) Avail: NTIS HC A07/MF A01 CSCL 05B

Research aimed at improving the economic information about Information Analysis Centers (IAC's) is summarized. The project involved measuring IAC users' perceptions of the relative value of information service characteristics. The findings suggest that IAC users attribute similar relative values to information service characteristics. The study found that nine service characteristics, synthesized from previous research and early results in this project, can be described by four independent dimensions: (1) data/information quality (associated with characteristics of precision, accuracy, and source credibility), (2) scope (associated with characteristics of recency and completeness of information), (3) 'hassle' (associated with the time lag in receiving the information, ease of service access, ease of use, and degree to which inhouse personnel are required), and (4) cost. GRA

N79-31079*# National Aeronautics and Space Administration, Washington, D. C.
PETITIONS FOR PATENT WAIVERS
Dec. 1978 103 p
(NASA-TM-80507; PB-289615/7; NHB-5500.1A-CH14) Avail: NTIS HC A06/MF A01 CSCL 05B

A supplement is presented to a previous publication which sets forth the findings of fact and recommendations of the NASA inventions and contributions board concerning selected petitions for waiver of rights by the United States to inventions made or that may be made in the performance of work under contracts with the National Aeronautics and Space Administration, as determined by the administrator. Lists of those petitions for which findings of fact are not digested in this publication, and of those on which action were deferred by the board, are included. GRA

N79-31080# National Technical Information Service, Springfield, Va.
COPYRIGHTS. A BILIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - May 1979
Mary E. Young Jun. 1979 129 p
(NTIS/PS-79/0574) Avail: NTIS HC $28.00/MF $28.00 CSCL 05B

Information on national and international copyrights is reviewed. Citations on the problems of copyrighted materials in computer data bases and of photocopying are included. GRA

N79-31081# Capital Systems Group, Rockville, Md.
IMPROVING THE DISSEMINATION OF SCIENTIFIC AND TECHNICAL INFORMATION: A PRACTITIONER'S GUIDE Final Report, 1974 - 1978
John M. Strawhorn, Elizabeth C. Fake, and Brigitte D. Huybrechts Nov. 1978 269 p refs Revised
(Contract NSF C-DSI-74-24410)
(PB-296536/6; NSF/IST-74/24410/14) Avail: NTIS HC A12/MF A01 CSCL 05B

Concepts, procedures, and technologies used to make scientific and technical publishing more effective and economical are presented. Innovations and improvements in conventional, journal, and monographic publishing print-on-paper alternatives to conventional publishing, and non print and mixed media innovations are described. 'Trends and prospects', 'innovations needed', and 'technology overviews', as well as a glossary and a list of suggested sources of additional information are included. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N79-31082# Department of Energy, Washington, D. C. Energy Information Administration.
EVALUATION OF FUTURE WORLD OIL PRICES
K. L. Kincel, C. Kilgore, and M. Rodekohr 2 Jun. 1978 81 p refs
(DOE/EIA-0102/4) Avail: NTIS HC A05/MF A01

An analysis is presented which documents an application of several EIA macroeconomic and energy models to the evaluation of higher world oil prices in the 1980's. An assessment of severe price increases is presented and several adjustments that were

made to the models in order to assess the higher world oil prices are included. DOE

N79-31083# Department of Energy, Dallas, Tex. Energy Information Administration.
REGIONAL RESIDENTIAL SECTOR ENERGY PRICE FORECASTS FOR 1978: ELECTRICITY, NATURAL GAS, NUMBER 2 FUEL OIL, AND PROPANE
P. Donvito and H. Walton Mar. 1979 20 p
(DOE/EIA-0102/46) Avail: NTIS HC A02/MF A01

The prices are intended for use in appliance labeling. Average (as opposed to marginal) prices were requested, because they were considered more comprehensible to consumers and, therefore, appropriate for labeling purposes. Regional prices were calculated from state data. State prices can vary substantially, even within regions. Consequently, state price data are also provided. The estimates for 1978 were developed by extending price trends from the three prior years for electricity and natural gas, and the previous 12 months for heating oil and propane. A discussion of the methods and sources used for each energy source is presented. DOE

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N79-31084# Committee on Science and Technology (U. S. House).
NASA AUTHORIZATION, 1980, VOLUME 1, PART 3
Washington GPO 1979 610 p refs Hearings on H.R. 1786 before the Subcomm. on Space Sci. and Applications of the Comm. on Sci. and Technol., 96th Congr., 1st Sess., 9-14 Feb. 1979
(GPO-46-422) Avail: Subcomm. on Space Sci. and Applications

Testimony received from personnel at the Kennedy, Johnson, and Marshall Centers as well as at the National Space Technology Laboratories and the Michoud 'facility' is presented. The President's budget plan for the Office of Space Science is discussed with implications for life sciences, planetary explorations, and physics and astronomy programs. Cooperative ventures with the European Space Agency are reviewed. A.R.H.

N79-31085# Committee on Science and Technology (U. S. House).
NASA AUTHORIZATION, 1980, VOLUME 1, PART 4
Washington GPO 1979 760 p refs Hearings on H.R. 1756 before the Subcomm. on Space Sci. and Applications of the Comm. on Sci. and Technol., 96th Congr., 1st Sess., 15, 21-22, 28 Feb., 9, 12 Mar. 1979
(GPO-46-423) Avail: Subcomm. on Space Sci. and Applications

Budget requests for NASA's Office of Space Transportation are justified with emphasis on the supplemental request for space shuttle appropriations. Space applications programs related to using space as a relay point, for Earth observation, and to exploit its specific characteristics are dicussed as well as the satellite conversion and transmission of energy to Earth. Field hearings at Rockwell International and Lockheed are included. A.R.H.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N79-31086# Patent and Trademark Office, Washington, D. C.
TECHNOLOGY ASSESSMENT AND FORECAST
Mar. 1979 190 p refs
(Rept-9) Avail: NTIS HC A09/MF A01

The most active domestic and foreign patent technologies are ranked and trends are noted. Patent activities in ferrous metal technologies are analyzed and specific processes and innovations are described. Appropriate technology for transfer to small businesses and developing nations is discussed. Tabular data shows the dates of U.S. patents granted and patented applications for 113 of the most patent active corporations and their subsidaries (1969-1977) period. A.R.H.

N79-31087*# Detroit Diesel Allison, Indianapolis, Ind.
CONCEPTUAL DESIGN STUDY OF AN IMPROVED GAS TURBINE (IGT) POWERTRAIN Report, Mar. - Nov. 1978
R. A. Johnson Jul. 1979 241 p refs Revised
(Contract DEN3-28)
(NASA-CR-159604; DDA-EDR-9719; DOE/NASA/0028-79/1)
Avail: NTIS HC A11/MF A01 CSCL 13F

Design concepts for an improved automotive gas turbine powertrain are discussed. Twenty percent fuel economy improvement (over 1976), competitive costs (initial and life cycle), high reliability/life, low emissions, and noise/safety compliance were among the factors considered. The powertrain selected consists of a two shaft gas turbine engine with variable geometry aerodynamic components and a single disk rotating regenerator. The regenerator disk, gasifier turbine rotor, and several hot section flowpath parts are ceramic. The powertrain utilizes a conventional automatic transmission. The closest competitor was a single shaft turbine engine matched to a continuously variable transmission (CVT). Both candidate powertrain systems were found to be similar in many respects; however, the CVT represented a significant increase in development cost, technical risk, and production start-up costs over the conventional automatic transmission. Installation of the gas turbine powertrain was investigated for a transverse mounted, front wheel drive vehicle. K.L.

N79-31088*# Ford Motor Co., Dearborn, Mich.
CONCEPTUAL DESIGN STUDY OF IMPROVED AUTOMOTIVES GAS TURBINE POWERTRAIN Final Report
May 1979 215 p refs Prepared in cooperation with AiResearch Mfg. Co., Phoenix, Ariz.
(Contracts DEN3-37; EC-77-A-31-1040)
(NASA-CR-159580; DOE/NASA/0037-79/1) Avail: NTIS HC A10/MF A01 CSCL 13F

Twenty-two candidate engine concepts and nineteen transmission concepts. Screening of these concepts, predominantly for fuel economy, cost and technical risk, resulted in a recommended powertrain consisting of a single-shaft engine, with a ceramic radial turbine rotor, connected through a differential split-power transmission utilizing a variable stator torque converter and a four speed automatic gearbox. Vehicle fuel economy and performance projections, preliminary design analyses and installation studies in a were completed. A cost comparison with the conventional spark ignited gasoline engine showed that the turbine engine would be more expensive initially, however, lifetime cost of ownership is in favor of the gas turbine. A powertrain research and development plan was constructed to gain information on timing and costs to achieve the required level of technology and demonstrate the engine in a vehicle by the year 1983. A.R.H.

N79-31089# Economics and Science Planning, Inc., Washington, D.C.
NEW ENGINEERING AND DEVELOPMENT INITIATIVES: POLICY AND TECHNOLOGY CHOICES. CONSENSUS VIEWS OF USER/AVIATION INDUSTRY REPRESENTATIVES, APPENDICES, VOLUME 2
1 Mar. 1979 196 p
(Contract DOT-FA77WA-4001)
Avail: NTIS HC A09/MF A01

Technology trends that will impact air transportation and aircraft industry are identified. Specifically, air traffic control automation, airport capacity (including noise considerations), freedom of airspace (emphasizing visual flight), and safety and flight control (with considerations on pilot decision making and improved weather information) are considered. J.M.S.

N79-31090# Economics and Science Planning, Inc., Washington, D.C.
NEW ENGINEERING AND DEVELOPMENT INITIATIVES: POLICY AND TECHNOLOGY CHOICES. CONSENSUS VIEWS OF USER/AVIATION INDUSTRY REPRESENTATIVES, VOLUME 1 Final Report
1 Mar. 1979 325 p refs
(Contract DOT-FA77WA-4001)
(N-150503-Vol-1) Avail: NTIS HC A14/MF A01

Productivity and automation (Air traffic control), airport capacity and route optimization, freedom airspace, safety and flight control, and non or low capital policies to improve efficiency are considered in terms of the forecasted rapid growth of air transportation and aircraft industry. Technological innovations are emphasized. J.M.S.

N79-31091*# Pennsylvania State Univ., University Park. Inst. for Policy Research and Evaluation.
DIFFUSION AND UTILIZATION OF SCIENTIFIC AND TECHNOLOGICAL KNOWLEDGE WITHIN STATE AND LOCAL GOVERNMENTS
Irwin Feller and Patricia E. Flanary Feb. 1979 191 p refs
(Contract NAS5-24329)
(NASA-CR-159936) Avail: NTIS HC A09/MF A01 CSCL 05B

The state-of-the-art is reviewed concerning current knowledge of processes by which technological innovation and scientific information are disseminated among state and local governments. The effectiveness of various mechanisms, strategies, and approaches by which federal agencies have sought to transfer technology to state, regional, and city governments are assessed. It is concluded that the existing relationships between the state and local governments, and the scientific communities are not adequate. F.O.S.

N79-31092*# Pennsylvania State Univ., University Park. Inst. for Policy Research and Evaluation.
DIFFUSION AND UTILIZATION OF SCIENTIFIC AND TECHNOLOGICAL KNOWLEDGE WITHIN STATE AND LOCAL GOVERNMENTS: EXECUTIVE SUMMARY
Irwin Feller and Patricia E. Flanary Jan. 1979 27 p refs
(Contract NAS5-24329)
(NASA-CR-159937) Avail: NTIS HC A03/MF A01 CSCL 05B

The requirements for technology transfer among the state and local governments are analyzed. Topics discussed include: information systems, federal funding, delivery channels, state executive programs, and state legislature requirements for scientific information. F.O.S.

N79-31093# Oak Ridge National Lab., Tenn.
ECONOMICS OF THE ANFLOW PROCESS FOR MUNICIPLE SEWAGE TREATMENT
W. L. Griffith Mar. 1979 88 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6574) Avail: NTIS HC A05/MF A01

The cost and energy requirements for conventional activated sludge, trickling-filter, and ANFLOW processes were compared to assess the potential of the ANFLOW process for municipal sewage treatment. Based on literature sources, capital-cost estimates, operating manpower requirements, energy requirements, and combined annual costs were developed for each alternative. DOE

N79-31094# Department of Energy, Washington, D. C. Office of Conservation and Solar Applications.
ELECTRIC HYBRID VEHICLE RESEARCH, DEVELOPMENT AND DEMONSTRATION PROGRAM: ENVIRONMENTAL ASSESSMENT
Mar. 1979 93 p refs
(DOE/EA-0075) Avail: NTIS HC A05/MF A01

The environmental impacts of the EHV demonstration are likely to be insignificant because of its relatively small scale, dispersed operation and high degree of control. Further, the slow pace and small buys in the beginning of the demonstration facilitate careful documentation of experience with EHV's and allow the opportunity to hold off later phases if serious difficulties arise with their use or manufacture. Potential safety and health impacts are the most significant, followed by socioeconomic impacts. Continued monitoring of the demonstration project as it progresses is essential to verify that it is operated as planned and that no major policy changes that affect environmental impacts are made without appropriate prior evaluation. DOE

N79-31095# Bendix Corp., Kansas City, Mo.
BENDIX KANSAS CITY DIVISION TECHNOLOGICAL SPINOFF THROUGH 1978
H. T. Barnes Feb. 1979 104 p refs
(Contract EY-76-C-04-0613)
(BDX-613-2141) Avail: NTIS HC A06/MF A01

A bibliography listing 2134 technological spinoff report is presented. Topics represented in the citations include chemical analysis and vapor deposition, deburring, electronic circuits and test equipment, elastomers, machining, measuring instruments, microelectronics, plastics, production methods, quality control, soldering, statistical analysis, and welding. Drawing sets released are also listed and locations of report collections in the U.S., other countries, and international agencies are provided. K.L.

N79-31096# Mitre Corp., McLean, Va.
AUTOMATED GUIDEWAY TRANSIT TECHNICAL DATA
A. Chambliss Apr. 1979 124 p Prepared for Urban Mass Transportation Admin.
(PB-295095/4; UMTA-VA-06-0041-79-4) Avail: NTIS HC A06/MF A01 CSCL 13F

Background data for general management-level discussions of Automated Guideway Transit (AGT) programs, systems, and other urban transportation modes are provided. Data are presented on general system characteristics, cost, energy, and environmental issues for AGT, rapid rail, light rail, and transit bus systems. In addition, a summary of 19 Downtown People Mover (DPM) proposals is provided. Raw data and assumptions are supplied in an appendix to provide a base for additional study. GRA

N79-31097# ASL Engineering, Goleta, Calif.
LOW LIFE CYCLE COST DESIGN STUDY FOR PARA-TRANSIT VEHICLES Final Report, Apr. - Nov. 1977
J. A. Bartol and J. G. Bishop Jul. 1978 204 p refs
(Contract DOT-TSC-1351)
(PB-295080/6; DOT-TSC-UMTA-78-14;
UMTA-MA-06-0052-78-6) Avail: NTIS HC A10/MF A01 CSCL 13F

The work performed on the low life Cycle Cost (LLCC) paratransit vehicle contract is summarized. The program was structured to provide a design of a vehicle suitable for taxi paratransit usage and optimized for LLCC to the end user. This effort is in response to the growing recognition that purchase price or first cost of a vehicle is not a true measure of the cost of ownership. Cost estimates which were prepared for the major elements of life cycle costing including manufacturing, maintenance, and repair costs are included. GRA

N79-31098# Little (Arthur D.), Inc., Cambridge, Mass.
CHARACTERIZATION OF HAZARDOUS WASTE TRANSPORTATION AND ECONOMIC IMPACT ASSESSMENT OF HAZARDOUS WASTE TRANSPORTATION REGULATIONS Final Report
1978 261 p refs
(Contract EPA-68-01-4381)
(PB-296497/1; EPA-530/SW-170C) Avail: NTIS HC A12/MF A01 CSCL 13B

Facilities, transportation activities, business/administrative practices, regulatory environment, and financial and economic structure of transporters of hazardous waste in the United States were considered. In addition, the costs of compliance with, and economic impact of, were considered. The EPA-proposed hazardous waste transportion regulations. Section 3003 of the Resource Conservation and Recovery Act (RCRA) were assessed. GRA

N79-31099# Harvard Univ., Cambridge, Mass. Landscape Architecture Research Office.
THE INTERACTION BETWEEN URBANIZATION AND LAND: QUALITY AND QUANTITY IN ENVIRONMENTAL PLANNING AND DESIGN
Mar. 1979 39 p refs

(Contract NSF ENV-72-03372)
(PB-295967; NSF/RA-780428) Avail: NTIS HC A03/MF A01 CSCL 13B

Vegetation-wildlife models applied to the evaluation of land-use change are discussed. Vegetation and wildlife are used to denote the more natural (less managed) features of the landscape: the various kinds of forests, vegetated open land wetlands, and water, and the assemblages of wild plants and animals that live there. These are resources that tend to diminish as urbanization continues. They also change from the natural processes of growth and succession. Objectives of the vegetation-wildlife model are to: (1) produce land classification systems that best serve the needs of the other two; (2) offer evaluations of these resources; and (3) offer methods of description and evaluation which are useful in the design process. When goals concerning these resources are envisioned, this model should facilitate the creation of regional plans and strategies that will achieve such goals. GRA

N79-31100# Georgia Inst. of Tech., Atlanta.
SINGLE-COMMODITY AND MULTI-COMMODITY NETWORK IMPROVEMENT PROCEDURES
Michael A. Mullens and Gunter P. Sharp Mar. 1979 289 p refs
(Contract DOT-OST-80050)
(PB-295482/4; DOT-OST-80050-1C) Avail: NTIS HC A13/MF A01 CSCL 13B

A multi-modal freight transport improvement problem is formulated, and a heuristic solution procedure is developed for large scale problems. Arcs on a multi-modal network are modified to minimize the sum of investment and shipper disutility. The modal includes a mode abstract multinomial logit model and convex arc transport characteristic improvement functions. The procedure is extended to include multiple transport commodity classes. GRA

N79-31101# Transportation Research Board, Washington, D. C.
URBAN TRANSPORT SERVICE INNOVATIONS
David W. Jones, Daniel Roos, Joseph S. Revis, V. Clayton Weaver, and James P. Womack 1979 150 p refs
(PB-294670/5; TRB/SR-184; ISBN-0-309-02817-5) Avail: NTIS HC A07/MF A01 CSCL 13B

This volume amounts to a progress report on paratransit. The papers published here include some that were presented at the Transportation Research Board Conference on Urban Transport Service Innovations held in San Diego, December 5-8, 1977, and some that were presented at the 55th Annual Meeting of the Board in Washington, D. C., January 16-20, 1978. They review both the American and Canadian experiences with shared-ride services such as car pools, van pools, group-ride taxi services, subscription bus services, dial-a-ride, and demand-responsive services for special-need groups. The discussion and debate that emerged in the conference focused on the issues of vertical and horizontal integration of transit and paratransit services, deregulation and entrepreneurship, and local flexibility in the context of full accreditation. GRA

N79-31102# Michigan Office of Science and Technology, Lansing.
SCIENCE AND TECHNOLOGY ADVICE FOR THE EXECUTIVE, THE MICHIGAN EXPERIENCE
William C. Taylor, Craig F. Nern, and James C. Kellogg Sep. 1978 30 p
(Grant NSF ISR-75-21490)
(PB-294738/0; NSF/RA-780497) Avail: NTIS HC A03/MF A01 CSCL 05B

The Office of Science and Technology provided an improved procedure by which information and advice on technical issues is presented to the Governor of Michigan for consideration in making state policy. Issues examined include a proposal to the Department of Defense to locate a massive communication antenna in Michigan, a chemical contaminating incident, a high-level nuclear waste disposal, low-level radioactive waste, and hazardous and toxic waste management. The report includes a description of the program's mode of operation and summaries of the above-mentioned issues. Principal findings center on a number of structural and procedural concepts. GRA

N79-31103# Fondo Colombiano de Investigaciones Cientificas y Proyectos Especiales, Bogota (Colombia).
APPROPRIATE TECHNOLOGY: CONCEPT, APPLICATION AND STRATEGIES
Bertha Salinas 1979 27 p refs Presented at the Intern. Seminar on Appropriate Technol. in Educ., Bogota, 29 Jan. - 2 Feb. 1979 Sponsored by UNESCO
(PB-294494/0) Avail: NTIS HC A03/MF A01 CSCL 05A

The areas discussed are: (1) the characteristics of appropriate technology; (2) appropriate technology and political projects; (3) fields of application and methodology; and (4) international and regional strategies to support appropriate technology. A reference list is included. GRA

N79-31104# Duke Univ., Durham, N. C. Dept. of Civil Engineering.
DYNAMIC THEORIES AND EXPERIMENTS OF ALTERNATIVE GUIDEWAY-VEHICLE SYSTEMS, PART 2 Final Report, Jun. 1977 - Mar. 1979
James F. Wilson Mar. 1979 189 p refs
(Contract DOT-OS-60130)
(PB-294247/2; DOT-RSPA-DPB-50-79-4) Avail: NTIS HC A09/MF A01 CSCL 13F

Alternative guideway systems are studied in terms of nondimensional parameters. Critical moment responses are predicted for simple, horizontally curved spans subjected to a variety of transit force distributions and torques. Measured moment responses are presented for curved, multiple spans with both even and uneven pier spacings and with several types of end constraints, all subjected to tandem vehicle loads. Dynamic responses are predicted for several three and six-span cable-stayed guideways subjected to a constant speed, vertical point force. Finally, a statistical response analysis is presented for an AGT vehicle traversing a ragid, statistically rough, banked, curved guideway. Those design parameters are identified which strongly affect the lateral rms accelerations and mean suspension system strokes. GRA

N79-31105# Office of Technology Assessment, Washington, D. C.
TECHNOLOGY ASSESSMENT OF CHANGES IN THE FUTURE USE AND CHARACTERISTICS OF THE AUTOMOBILE TRANSPORTATION SYSTEM. SUMMARY AND FINDINGS
Feb. 1979 48 p refs 2 Vol.
(PB-293645/8; OTA-T-83; LC-79-600030-1) Avail: NTIS HC A03/MF A01 CSCL 13F

The assessment deals with changes in the future use and characteristics of the automobile transportation system that are expected in the near term (by 1985) and those that might evolve over a longer period (through 2000 and beyond). The scope of the assessment is broad and includes not only automobiles but also highways, fuel supply and distribution, automotive repair and service, insurance, traffic management, and law enforcement in short, all of the industries and services that contribute to use of the automobile as a mode of personal transportation. The report analyzes the restraints of energy supply, environmental impacts, highway safety, and consumer cost on the further development of the automobile transportation system. It discusses Government initiatives that may be necessary to assure such further development. GRA

N79-31106# Office of Technology Assessment, Washington, D. C.
TECHNOLOGY ASSESSMENT OF CHANGES IN THE FUTURE USE AND CHARACTERISTICS OF THE AUTOMOBILE TRANSPORTATION SYSTEM, VOLUME 2
Feb. 1979 385 p refs 2 Vol.
(PB-293646/6; OTA-T-84; LC-79-600030-2) Avail: NTIS HC A17/MF A01 CSCL 13F

The report consists of three parts. The first part contains background information, a description of the elements of the automobile transportation system. Base Case projections, and delineation of the policy alternatives that were considered. A baseline of present and future automobile system characteristics that serve as the frame of reference for policy analysis is provided. The second part contains analyses of policy options in each of the five issue areas: energy, environment, safety, mobility, and

cost and capital. A discussion of issues, a summary of present policy, a statement of policy options and analysis of effects and impacts are included. The third part is a survey of expected technological developments in the near term (through 1985) and in the far term (to 2000 and beyond). A summary of major findings is also included. GRA

N79-31107# Minibus Forest, Inc., Montreal (Quebec).
MODIFICATION AND EVALUATION OF A SMALL STATION WAGON DESIGNED FOR TRANSPORTATION OF THE HANDICAPPED Final Report
Jacques Forest and C. A. Versailles Jun. 1978 40 p Transl. into ENGLISH of Can. Rept. on Elderly and Handicapped Modification Tests Sponsored by DOT and Centre de Rech. et de Develop. Transports Can.
(Proj. 6281)
(PB-295106/9; UMTA-MA-06-0025-79-12; TP-1777) Avail: NTIS HC A03/MF A01 CSCL 13F

The project was designed to modify and evaluate a small stationwagon to be used to transport handicapped people in a door-to-door service. The project made it possible to determine specific data in terms of future modifications. The report concludes that: (1) the project shows that a small modified stationwagon can be used to transport handicapped people and provide both a useful and viable service; (2) the prototype evaluated has the required size, capacity, comfort, and versatility; and (3) the cost of modification, the weight and gas consumption could be substantially reduced if these vehicles were modified en masse, because that would justify using a fiberglass body rather than a steel one. GRA

N79-31108# Houston Univ., Tex. Coll. of Business Administration.
TECHNICAL INFORMATION FLOWS AND INNOVATION PROCESSES, EXECUTIVE SUMMARY Final Report
Robert T. Keller and Winford E. Holland Oct. 1978 5 p
(Grant NSF PRA-76-18441)
(PB-294925/3; NSF/PRA-7618441/1) Avail: NTIS HC A02/MF A01 CSCL 05A

The types of boundary-spanning activity needed to effectively transfer scientific and technological information to achieve innovation were examined as well as the personal characteristics and traits associated with effective boundary spanners. It also identified selection and training managerial strategies for improving scientific and technological information communication. One industrial R&D organization and two governmental R&D organizations provided a sample of 256 professional employees for the study. It was concluded that scientific and technological information boundary-spanning activity are most related to innovativeness and effective boundary spanners tend to have a low need for clarity and a high innovation orientation. GRA

N79-31109# Houston Univ., Tex. Coll. of Business Administration.
TECHNICAL INFORMATION FLOWS AND INNOVATION PROCESSES Final Report
Robert T. Keller and Winford E. Holland Oct. 1978 150 p refs
(Grant NSF PRA-76-18441)
(PB-294400/7; NSF/PRA-7618441/2) Avail: NTIS HC A07/MF A01 CSCL 05J

Data were collected from three separate sources: peer nominations, management ratings, and self-report questionnaires. It was concluded that scientific and technological information boundary-spanning activity are most related to innovativeness and that effective boundary spanners tend to have a low need for clarity and a high innovation orientation. GRA

N79-31110# Transportation Systems Center, Cambridge, Mass.
DIESEL BUS PERFORMANCE SIMULATION PROGRAM Final Report, Mar. 1977 - Apr. 1979
Glenn Larson and Harry Zuckerberg Apr. 1979 206 p refs
(PB-295524/3; DOT-TSC-UMTA-79-16; UMTA-MA-06-0044-79-1) Avail: NTIS HC A10/MF A01 CSCL 13F

A diesel bus performance computer simulation program was developed. This program provides information on acceleration, velocity, horsepower, distance traveled, and fuel comsumption as a function of time from the originating station. The program was written for diesel engine operation although heat engines other than diesel may be substituted. Fuel economy calculations, using the program, agree well with available measurements on urban buses and may be considered as representative of a baseline urban bus. Component submodels and vehicle coefficients used in the program were carefully structured to represent current urban buses. A general description of the simulation program and the type of input data it required along with the results obtained by simulating a typical transit bus are included. GRA

88 SPACE SCIENCES (GENERAL)

N79-31111* National Aeronautics and Space Administration, Washington, D. C.
A BIBLIOGRAPHY OF PLANETARY GEOLOGY PRINCIPAL INVESTIGATORS AND THEIR ASSOCIATES, 1978 - 1979
Joseph M. Boyce, comp. Aug. 1979 83 p
(NASA-TM-80540) Avail: NTIS HC A05 CSCL 03B

Approximately 450 articles on planetary geology are reported. M.M.M.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N79-31112# Astronomische Rechen-Institut, Heidelberg (West Germany).
ACTIVITIES REPORT, 1976 Annual Report [TAETIGKEITS-BERICHT]
W. Fricke Jan. 1976 9 p refs In GERMAN
Avail: NTIS HC A02/MF A01

A list of congresses and conferences in which the Institute actively participated is given. An IBM/360-44 computer was installed in May. Work was continued for the International YearBook: Apparent Places of Fundamental Stars. Other scientific work included deriving a new fundamental reference coordinate system and astronomical constants, preparation of material for Astronomy and Astrophysics Abstracts, investigating astronomical principles for the calendar, and studies of celestial mechanics, small planets, star clusters, and nearly stars. Author (ESA)

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N79-31113*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TO THE SOLAR FOCI
David Sonnabend 1 Jun. 1979 334 p refs
(Contract NAS7-100)
(NASA-CR-162102; JPL-Pub-79-18) Avail: NTIS HC A15/MF A01 CSCL 03B

Earlier authors showed that the sun is likely to act as a lens for gravitational radiation, with focui in the outer solar system. They suggested that missions to these foci have the potential of directly measuring the density structure of the sun. Other applications include gravitational wave astronomy and tests of general relativity. This idea is reexamined, concentrating on the engineering aspects of focal missions; primarily spacecraft design and performance. Other topics studied include solar optics, gravitational wave detectors, navigation, and the design of missions for different purposes. Specifically, it is shown that shuttle launched chemical rockets have a substantial capability for reaching some foci; and that all can be reached with large payloads using nuclear isotope-electric propulsion. G.Y.

N79-31114*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A LIMIT TO THE X-RAY LUMINOSITY OF NEARBY NORMAL GALAXIES
D. M. Worrall, F. E. Marshall, and E. A. Boldt Jul. 1979 11 p refs Submitted for publication
(NASA-TM-80321) Avail: NTIS HC A02/MF A01 CSCL 03B

Emission is studied at luminosities lower than those for which individual discrete sources can be studied. It is shown that normal galaxies do not appear to provide the numerous low luminosity X-ray sources which could make up the 2-60 keV diffuse background. Indeed, upper limits suggest luminosities comparable with, or a little less than, that of the galaxy. This is consistent with the fact that the average optical luminosity of the sample galaxies within approximately 20 Mpc is slightly lower than that of the galaxy. An upper limit of approximately 1% of the diffuse background from such sources is derived. K.L.

N79-31115*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE SHAPE AND LOCATION OF THE SECTOR BOUNDARY SURFACE IN THE INNER SOLAR SYSTEM
U. Villante (L'Aquila Univ., Italy), R. Bruno (L'Aquila Univ., Italy), F. Mariani (Rome Univ., Italy), L. F. Burlaga, and N. F. Ness Jul. 1979 25 p refs Submitted for publication
(NASA-TM-80326) Avail: NTIS HC A02/MF A01 CSCL 03B

Simultaneous observations by Helios-1 and Helios-2 over four solar rotations were used to determine the latitudinal dependence of the polarity of the interplanetary magnetic field within plus or minus 7.23 deg of the solar equator and within 1 AU. The longitudinal and latitudinal positions of the sector boundary crossing are consistent with a warped sector boundary which extended from the sun to 1 AU and was inclined approximately 10 deg with respect to the heliographic equator. This is consistent with simultaneous Pioneer 11 observations, which showed unipolar fields at latitude approximately 16 deg at heliocentric distances greater than 3.5 AU. Two sectors were observed at southern latitudes; however, four sectors were observed at northern latitudes on two rotations, indicating a distortion from planarity of the sectory boundary surface. Author

N79-31116*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MAGNETIC FIELD DIRECTIONAL DISCONTINUITIES. 1: MINIMUM VARIANCE ERRORS
R. P. Lepping and K. W. Behannon Jun. 1979 39 p refs Submitted for publication
(NASA-TM-80307) Avail: NTIS HC A03/MF A01 CSCL 03B

Errors associated with the minimum variance analysis of directional discontinuity normal components were investigated using both computer simulation of discontinuities with controlled properties and the examination of current sheets observed by the Mariner 10 spacecraft. The simulated discontinuities were created by adding fluctuations, represented by isotropic noise, to exactly known but varying (in a plane) magnetic field components. An empirical expression for the magnitude of the error in an estimated discontinuity normal component, relative to the total field across the discontinuity, was derived, as well as other relevant statistical properties. Use of the empirical relation in the analysis of 644 discontinuities observed by Mariner 10 provides a more precise, but probably conservative, estimate of an upper bound on the relative normal component value for tangential discontinuities that can be used to separate rotational from tangential discontinuities in studies using only magnetic field data from a single spacecraft, at least for the interplanetary region of space considered. A.R.H.

N79-31117*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HEAO-1 SPECTRA OF X-RAY EMITTING SEYFERT 1 GALAXIES
R. F. Mushotzky, F. E. Marshall, E. A. Boldt, S. S. Holt, and P. J. Serlemitsos Aug. 1979 29 p refs Submitted for publication
(NASA-TM-80554) Avail: NTIS HC A03/MF A01 CSCL 03B

The A-2 experiment on HEAO-1 determined spectral parameters for seven Seyfert 1 galaxies: NGC3783, NGC4151, NGC5548, NGC6814, MK509, MCG8-11-11, and ES0141-G55. The X-ray spectra above 5 keV can be well fit by power laws of energy index alpha between .3 and 1.0 and, with the exception of MK509, by a high temperature (kt > 15 keV) thermal bremsstrahlung spectrum. The column densities, with the exception of NGC4151, are less than 5 x 10 to the 22nd power at/sq cm with only the low luminosity objects having measurable columns. Galaxy ES0141-G55 showed a strong soft X-ray excess in March 1978 similar to that seen in the BL lac object MK421. Variability on a six month time scale was exhibited by MCG8-11-11, NGC3783, and possibly NGC6814. Various correlations between optical and X-ray properties are discussed. Using the typical Seyfert 1 spectrum their contribution to the diffuse X-ray background above five keV is computed. K.L.

N79-31118*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTERPLANETARY PARTICLES AND FIELDS, NOVEMBER 22 - DECEMBER 6, 1977: HELIOS, VOYAGER, AND IMP OBSERVATIONS BETWEEN 0.6 AU AND 1.6 AU
L. F. Burlaga, R. P. Lepping, R. Weber, T. Armstrong, C. Goodrich, J. Sullivan, D. Gurnett, P. Kellogg, E. Keppler, F. Mariani et al Jul. 1979 53 p Submitted for publication
(NASA-TM-80333) Avail: NTIS HC A04/MF A01 CSCL 03B

The principal interplanetary events observed are described and analyzed. Three flow systems were observed: (1) a corotating stream and a stream interface associated with a coronal hole; (2) a shock wave and an energetic particle event associated with a 2-B flare; and (3) an isolated shock wave of uncertain origin. Data from 28 experiments and 6 spacecraft provide measurements of solar wind plasma, magnetic fields, plasma waves, radio waves, energetic electrons, and low energy protons. K.L.

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N79-31119*# Biospherics, Inc., Rockville, Md.
ANALYSIS AND INTERPRETATION OF VIKING LABELED RELEASE EXPERIMENTAL RESULTS Final Report, 15 Feb. 1978 - 15 Feb. 1979
Gilbert V. Levin 19 Jun. 1979 121 p refs
(Contract NASw-3162)
(NASA-CR-162149) Avail: NTIS HC A06/MF A01 CSCL 03B

The Viking Labeled Release (LR) life detection experiment on the surface of Mars produced data consistent with a biological interpretation. In considering the plausibility of this interpretation, terrestrial life forms were identified which could serve as models for Martian microbial life. Prominent among these models are lichens which are known to survive for years in a state of cryptobiosis, to grow in hostile polar environments, to exist on atmospheric nitrogen as sole nitrogen source, and to survive without liquid water by absorbing water directly from the atmosphere. Another model is derived from the endolithic bacteria found in the dry Antarctic valleys; preliminary experiments conducted with samples of these bacteria indicate that they produce positive LR responses approximating the Mars results. However, because of the hositility of the Martian environment to life, and the failure to find organics on the surface of Mars, a number of nonbiological explanations were advanced to account for the Viking LR data. A reacton of the LR nutrient with putative surface hydrogen peroxide is the leading candidate. Other possibilities raised include reactions caused by or with ultraviolet

irradiation, gamma-Fe2O3, metalloperoxides or superoxides. F.O.S.

N79-31120*# Physics International Co., San Leandro, Calif.
IMPACT CRATERING CALCULATIONS. PART 1: EARLY TIME RESULTS Interim Final Report
Jeffrey M. Thomsen, Fred N. Sauer, Michael G. Austin, Stephen F. Ruhl, Peter H. Shultz (Lunar Planetary Inst., Houston, Tex.), and Dennis L. Orphal (Calif. Research and Technol., Inc., Livermore) 11 Aug. 1979 114 p refs
(Contract NASw-3168)
(NASA-CR-162148; PIFR-1220) Avail: NTIS HC A06/MF A01 CSCL 03B

Early time two dimensional finite difference calculations of laboratory scale hypervelocity impact of 0.3 g spherical 2024 aluminum projectiles into homogeneous plasticene clay targets were performed. Analysis of resulting material motions showed that energy and momentum were coupled quickly from the aluminum projectile to the target material. In the process of coupling, some of the plasticene clay target was vaporized while the projectile become severely deformed. The velocity flow field developed within the target was shown to have features similar to those found in calculations of near surface explosion cratering. Specific application of Maxwell's analytic Z-Model showed that this model can be used to describe the early time flow fields resulting from the impact cratering calculations as well, provided the flow field centers are located beneath the target surface and most of the projectile momentum is dissipated before the model is applied. K.L.

N79-31121*# Cornell Univ., Ithaca, N. Y. Center for Radiophysics and Space Research.
OCCULTATION STUDIES OF PLANETS AND SATELLITES: THE OCCULTATION OF EPSILON GEMINORUM BY MARS Final Technical Report, 1 Feb. - 31 Aug. 1976
James L. Elliot, Joseph Veverka, and Carl Sagan [1977] 30 p refs
(Grant NsG-7243)
(NASA-CR-162114) Avail: NTIS HC A03/MF A01 CSCL 03B

The occultation of epsilon Geminorum by Mars on 1976 April 8 was observed at three wavelengths and 4 ms time resolution with the 91 cm telescope. Temperature, pressure, and number density profiles of the Martian atmosphere were obtained for both the immersion and emersion events. Within the altitude range of 50 to 80 km above the mean surface, the mean temperature is 145 K, and the profiles exhibit wavelike structures with a peak to peak amplitude of 35 K and a vertical scale of about 20 km. The ratio of the refractivity of the atmosphere at 4500 A and 7500 A, determined from the time shift of the light curves for these wavelengths, is consistent with the atmospheric composition measured by Viking 1, 15 weeks later. From the central flash - a bright feature in the light curve midway between immersion and emersion - an optical depth is found at 4500 A of 3.3 plus or minus 1.7 per km atm (about 0.23 per equivalent Martian air mass) for the atmosphere about 25 km above the mean surface, near the south polar region. This large value and its weak wavelength dependence rule out Rayleigh scattering as the principal cause of the observed extinction. A.W.H.

N79-31122*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
STUDY OF MASS FLOW DISTRIBUTION AND CHEMICAL COMPOSITION OF COMETS FROM SOLAR INDUCED X-RAY FLUORESCENCE Final Report, 1 Oct. 1977 - 30 Sep. 1978
Paul Gorenstein Aug. 1979 26 p
(Grant NsG-7380)
(NASA-CR-162136) Avail: NTIS HC A03/MF A01 CSCL 03B

The expected performance of an X-ray detector as an instrument aboard a mission to a comet was evaluated. The functions of the detector are both nondispersive analysis of chemical composition and measurement of mass flow from the comet nucleus. Measurements are to be carried out at a distance from the comet. The approach distances considered are of the order of 1000 km and 100 km. A new type of X-ray detector, a proportional scintillation detector, is considered as an X-ray counter for nondispersive elemental analysis. G.Y.

N79-31123*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
AN INVESTIGATION AND ANALYSIS OF THE DENSITY AND THERMAL BALANCE OF THE MARTIAN IONOSPHERE
Ronald P. Rohrbaugh 27 Jul. 1979 177 p refs
(Grant NGL-39-009-003)
(NASA-CR-162141; PSU-IRL-SCI-463) Avail: NTIS HC A09/MF A01 CSCL 03B

The major photochemistry consisted of solar EUV and photoelectrons comprising 70 percent and 30 percent respectively, of the initial source of CO2(+) and O(+). The energetic O2(+) provided a substantial source of energy to the ambient ions, distributing of the order of 1.6 x 10 to the -7 power W/sq m at an average of 160 km. This input can be compared to that from the ambient electrons of 1.3 x 10 to the -7 power W/sq m with average deposition at 145 km and from the calculated thermal conduction of 1 x 10 to the -9 power W/sq m at 270 km and 1 x 10 to the -8 power at 230 km for assumed dip angles of 2 deg and 12 deg respectively, for a 10nT magnetic field. At altitudes above 250 km upward, vertical fluxes of the order 6 x 10 to the 10th power/sq m/sec for the thermal ions were calculated. The net ionization of O(+) and CO2(+) by charge exchange with incoming solar wind protons varied from 5 x 10 to the 8th power to 5 x 10 to the 12th power /sq m/sec for assumed field strengths of 50nT to 2nT on the dayside of the planet. Author

N79-31124*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
GALILEO TO JUPITER. PROBING THE PLANET AND MAPPING ITS MOONS
1979 21 p Sponsored by NASA Orginal contains color illustrations
(NASA-CR-162142; JPL-400-15-7/79) Avail: NTIS HC A02/MF A01 CSCL 03B

The first project to use the space shuttle as an interplanetary launch vehicle, the Galileo mission is designed to obtain information about the origin and evolution of the solar system by studying large-scale phenomena on Jupiter and its satellites. Aimed towards Mars to obtain gravity assist, the orbiting spacecraft will deploy a probe, which penetrating the Jovian atmosphere, will transmit data for approximately an hour. The spacecraft itself will inspect the atmospheres, ionospheres, and surfaces of Ganymede, Io, Europa, and Callisto, as well as determine their magnetic and gravitational properties. The experiments to be conducted and their scientific objectives are described. Known facts about the Jovian system are reviewed. A.R.H.

N79-31125*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DECAMETER: WAVE RADIO OBSERVATIONS OF JUPITER DURING THE 1970 APPARITION
S. S. Vaughan (Computer Science Corp., Silver Spring, Md.), J. R. Thieman, and J. K. Alexander Aug. 1979 27 p refs
(NASA-TM-80549) Avail: NTIS HC A03/MF A01 CSCL 03B

Observations of Jupiter's sporadic decameter wavelength radio emissions were obtained between November 1978 and March 1979. A multistation, global network of monitoring instruments were utilized in order to obtain nearly continuous, synoptic observations of the planet. Observations were obtained daily at frequencies of 16.7 and 22.2 MHz using five element Yagi antennas at each end of a two element interferometer. A.W.H.

N79-31126*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PSEUDOCRATERS ON MARS
Herbert Frey, Barbara L. Lowry, and Scott A. Chase Jul. 1979 18 p refs Submitted for publication
(Grant NGL-21-002-033)
(NASA-TM-80279) Avail: NTIS HC A02/MF A01 CSCL 03B

The morphology and origin of the Martian volcanic-dome

like structures are compared to the terrestial pseudocraters. M.M.M.

N79-31127*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LARGE IMPACT BASINS ON MERCURY AND RELATIVE CRATER PRODUCTION RATES
Herbert Frey and Barbara L. Lowry Jul. 1979 22 p refs Submitted for publication
(NASA-TM-80317) Avail: NTIS HC A02/MF A01 CSCL 03B

Mariner 10 revealed evidence for 40 impact basins having diameters greater than or equal to 200 km on the portion of Mercury imaged at sufficient resolution. A log (cumulative number/unit area) vs. log (diameter) plot for the mercurian basins has a least squares slope of -2. Mercury has (in cumulative number/unit area) only 37 percent as many basins as does the Moon over the entire range of diameters greater than or equal to 300 km. If both the Moon and Mercury have had similar preservation times for craters and if common populations of impactors are involved, then Mars crossers may have been a dominant contribution to the basin forming objects. K.L.

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N79-31128*# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.
EFFECTS OF THE SOLAR WIND ON MAGNETOSPHERIC DYNAMICS: ENERGETIC ELECTRONS AT THE SYNCHRONOUS ORBIT
G. A. Paulikas and J. B. Blake 27 Nov. 1978 46 p refs (Contract NAS5-23788)
(NASA-CR-159948; ATR-79(7642)-1) Avail: NTIS HC A03/MF A01 CSCL 03B

A correlation of the observations of energetic electron fluxes at the synchronous orbit with the interplanetary medium and the behavior of energetic trapped radiation at the synchronous altitude were analyzed. Data covering the 1967 to 1978 interval were obtained by the ATS 1, ATS 5, and ATS 6 spacecraft. Long term (year) and short term (days) electron flux averages are found to correlate positively with corresponding averages of the solar wind velocity. A.W.H.

N79-31129# Los Alamos Scientific Lab., N. Mex.
SOLAR WIND ACCELERATION IN CORONAL HOLES
R. A. Kopp 1978 10 p refs Presented at the 4th Intern. Conf. on Solar Wind, Burghausen, West Germany, 28 Aug. 1978
(Contract W-7405-eng-36)
(LA-UR-78-3156; Conf-780890-3) Avail: NTIS HC A02/MF A01

The extended nonthermal heating of the corona, heat flux inhibition, or direct addition of momentum to the expanding coronal plasma were considered in explaining the large solar wind velocities in high streams. A nonthermal mechanism to provide the bulk acceleration of the high wind plasma close to the sun was pointed out. The direct addition of the momentum carried by outward-propagating waves to the expanding corona proved necessary to build quantitatively self-consistent models of coronal holes and high speed solar wind streams. DOE

N79-31130# European Space Agency, Paris (France).
LABORATORY MEASUREMENTS OF THE SOLAR REEMISSION FACTOR g SUB 1.0 OF THE NO-GAMMA BAND AT 2147 A FOR THE DETERMINATION OF THE DENSITY OF NITRIC OXIDE IN THE D-REGION OF THE IONOSPHERE
Joachim Laudam May 1979 108 p refs Transl. into ENGLISH of 'Labormessung des solaren Reemississionsfaktors g sub 1.0 der NO-gamma bande bei 2147 A zur Dichtebestimmung von stickstoffmonoxide in der D-Schict der Ionosphaere', DFVLR, Oberpfaffenhofen, West Ger. Report DLR-FB-77-30 12 Jul. 1977 Original report in GERMAN previously announced as N78-31653 Original German report available from DFVLR, Cologne DM 47 (ESA-TT-517; DLR-FB-77-30) Avail: NTIS HC A06/MF A01

The reemission factor of the solar ultraviolet resonance emission in the NO gamma (1.0) band was determined under laboratory conditions in order to calculate the density of nitric oxide in the D region of the ionosphere. A special NO measuring chamber was built for this purpose. The most commonly used valve of 9 = 3.93 x ten to the -6 power by Pearce could not be confirmed by directphoton measurement, but rather the still unpublished valve of 9 = 7.05 x ten to the -6 power by Witt could. Thus, earlier rocket measurements are to be corrected, since different g factors were used. This work is related to the German rocket compaign (1975 to 1977) which investigated the winter anomaly of radio wave absorption in the D layer which is chiefly caused by the ionization of NO. Author (ESA)

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N79-31131*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LASER MEASURING SYSTEM FOR WIRE-WRAPPED FRAME ASSEMBLIES
John G. Etzel and James A. Munford Mar. 1979 41 p
(NASA-TM-79715) Avail: NTIS HC A03/MF A01 CSCL 14B

The laser measuring system is designed to automatically measure and record the distances between small diameter wires on a wire wrapped grid frame assembly to an accuracy of 0.00635 mm (0.00025 in.). The system utilizes a helium-neon gas laser beam as the measuring instrument with a remote interferometer and retroreflector, a light source and photodetector to detect the wire positions, in conjunction with recording, display and printout units. The laser measuring system is utilized to perform precise automatic measurements for wire application machines or as an automatic feedback device for positioning wires and/or to adjust them for out of tolerance conditions. A.W.H.

N79-31132*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE DIFFUSE X-RAY BACKGROUND SPECTRUM FROM 3 TO 50keV
F. E. Marshall, E. A. Boldt, S. S. Holt, R. Miller, R. F. Mushotzky, L. A. Rose, R. E. Rothschild, and P. J. Serlemitsos Jul. 1979 25 p refs Submitted for publication
(NASA-TM-80329) Avail: NTIS HC A02/MF A01 CSCL 03B

The spectrum of the extragalactic diffuse X-ray background was measured with the GSFC cosmic X-ray experiment on HEAO-1 for regions of the sky away from known point sources and more than 20 deg from the galactic plane. A total exposure of 80 sq m-sec-sr is available at present. Free-free emission from an optically thin plasma of 40 plus or minus 5 keV provides an excellent description of the observed spectrum from 3 to 50 keV. This spectral shape is confirmed by measurements from 5 separate layers of three independent detectors. With an estimated absolute precision of about 10 percent, the intensity of the emission at 10 keV is 3.2 keV/keV-sq cm-sec-sr, a value consistent with the average of previously reported spectra. No other spectral features, such as iron line emission, are evident. This spectrum is not typical of known extragalactic objects. A uniform hot intergalactic medium of approximately 36 percent of the closure density of the universe would produce such a flux, although non-uniform models indicating less total matter are probably more realistic. Author

N79-31133*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MEASUREABLE CHARACTERISTICS OF EXTRATERRESTRIAL SOURCES OF HIGH ENERGY NEUTRINOS
J. Learned (California Univ., Irvine) and F. W. Stecker Aug. 1979 11 p refs Submitted for publication

(DE-AT03-76ER70149)
(NASA-TM-80544) Avail: NTIS HC A02/MF A01 CSCL 03B

Calculations were carried out to determine the characteristics of extraterrestial neutrino sources that could be observed in a high energy (> 1 TeV) neutrino detector given an adequate source intensity. Measureable quantities such as <y> and the ratio of muonless to muon containing events can, potentially, reveal source characteristics such as charge state (matter or antimatter), density, and local particle spectrum. Comparisons were made with the flux of atmospheric neutrinos including the effects of prompt neutrinos. K.L.

99 GENERAL

N79-31134# European Space Agency, Paris (France).
EUROPEAN SPACE PROGRAMS AND SCIENTIFIC ACTIVITIES FOR 1978 Annual Report
1978 171 p
Avail: NTIS HC A08/MF A01

An assessment of the year's work as directed by the European Space Agency (ESA) is given. Activities reported on include 1978 launchings, research and communications programs, the Earth Observation Program, progress made with Spacelab and the Ariane launcher as well as work done at the Villafranca tracking station near Madrid, Spain, and results obtained in the organization of the Information Retrieval Service of ESA. Author (ESA)

N79-31135# National Bureau of Standards, Washington, D. C.
JOURNAL OF RESEARCH OF THE NATIONAL BUREAU OF STANDARDS, VOLUME 83, NO. 6, NOVEMBER - DECEMBER 1978
1978 81 p refs
(PB-293447/9; LC-62-37059) Avail: NTIS HC A05/MF A01 CSCL 07D

Contents: enthalpies of solution of the nucleic acid bases, 2-Thymine in water, enthalpies of solution of the nucleic acid bases. 3-Cytosine in water; enthalpies of solution of the nucleic acid bases. 4-Uracil in water; neutron flux intercomparison at NBS; a critical review of comparisons of mathematical programming algorithms and software; partitioned and hadamard product matrix inequalities and the phase-shifting limit cycles of the van der Pol equation. GRA

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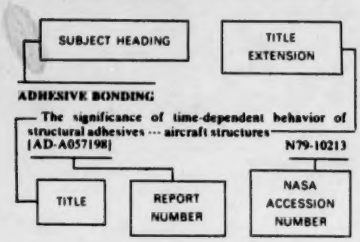

The subject heading is the key to the subject content of the document. Titles, report numbers, and accession numbers of pertinent documents are provided under each subject heading. When the title is insufficiently descriptive of the document content, a title extension has been added, separated from the title by three hyphens. The report number helps to indicate the type of document cited (e.g., NASA report, NASA translation, NASA contractor report). The NASA accession number is the number by which the document abstracts are arranged in this journal and by which the document is sold or requested. The titles, with title extensions if present, are arranged under each subject heading in ascending accession number order. The subject headings have been selected from the latest revision of the *NASA Thesaurus* (NASA SP-7050).

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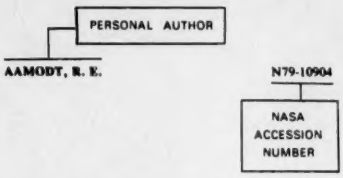

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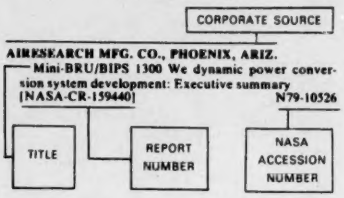

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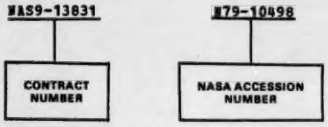

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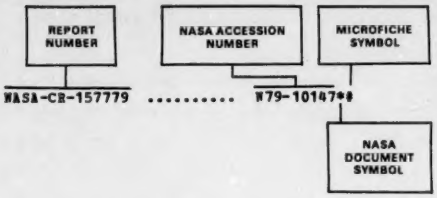

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NASA-CR-159594 ..... N79-30295*#
NASA-CR-159604 ..... N79-31087*#
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NASA-CR-159635 ..... N79-30514*#
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NASA-CR-159949 ..... N79-30711*#
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NASA-CR-160264 ..... N79-30600*#
NASA-CR-160270 ..... N79-30601*#
NASA-CR-160294 ..... N79-30270*#
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NASA-CR-160296 ..... N79-30267*#
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NASA-CR-160298 ..... N79-30269*#
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NASA-CR-162111 ..... N79-30283*#
NASA-CR-162112 ..... N79-30512*#
NASA-CR-162113 ..... N79-30714*#
NASA-CR-162114 ..... N79-31121*#
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NASA-CR-162137 ..... N79-30987*#
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NASA-CR-162139 ..... N79-30570*#
NASA-CR-162140 ..... N79-30193*#
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NASA-TM-78126 ..... N79-30475*#
NASA-TM-78533 ..... N79-30146*#
NASA-TM-78603 ..... N79-30143*#
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NASA-TM-79170 ..... N79-30719*#
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NASA-TM-80297 ..... N79-30568*#
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NASA-TM-80321 ..... N79-31114*#
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NASA-TM-80509 ..... N79-30244*#
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NASA-TM-80544 ..... N79-31133*#
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NASA-TP-1435 ..... N79-30176*#
NASA-TP-1455 ..... N79-30518*#
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NASA-TP-1483 ..... N79-30191*#
NASA-TP-1524 ..... N79-30381*#
NASA-TP-1525 ..... N79-30380*#
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NBS-HB-105-3 ..... N79-30419 #

NBS-SP-260-62 ..... N79-30292 #
NBS-SP-400-54 ..... N79-30494 #
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NBS/GCR-79/166 ..... N79-30541 #

NBSIR-79-1591 ..... N79-30897 #
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NOAA-TM-NWS-CR-64 ..... N79-30901 #

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NOAA-78092702 ..... N79-30903 #
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NOAA-79040901 ..... N79-30704 #
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NSF/RA-780428 ..... N79-31099 #
NSF/RA-780435 ..... N79-30858 #
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NTIS/PS-75/237 ..... N79-30928 #
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NTIS/PS-75/384 ..... N79-30930 #
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NTIS/PS-76/0222 ..... N79-30857 #
NTIS/PS-76/0305 ..... N79-30418 #
NTIS/PS-76/0313 ..... N79-30493 #
NTIS/PS-76/0325 ..... N79-31077 #
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NTIS/PS-76/0378 ..... N79-30928 #
NTIS/PS-76/0387 ..... N79-30930 #
NTIS/PS-76/0468 ..... N79-30707 #
NTIS/PS-76/0469 ..... N79-30708 #
NTIS/PS-77/0212 ..... N79-30857 #
NTIS/PS-77/0257 ..... N79-30495 #
NTIS/PS-77/0268 ..... N79-30418 #
NTIS/PS-77/0300 ..... N79-30493 #
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NTIS/PS-77/0532 ..... N79-30707 #
NTIS/PS-77/0533 ..... N79-30708 #
NTIS/PS-78/0314 ..... N79-30857 #
NTIS/PS-78/0316 ..... N79-30418 #
NTIS/PS-78/0334 ..... N79-30493 #
NTIS/PS-78/0351 ..... N79-30542 #
NTIS/PS-78/0352 ..... N79-30543 #
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NTIS/PS-78/0410 ..... N79-30163 #
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NTIS/PS-78/0432 ..... N79-30930 #
NTIS/PS-78/0443 ..... N79-30928 #
NTIS/PS-78/0563 ..... N79-30707 #
NTIS/PS-78/0564 ..... N79-30708 #
NTIS/PS-79/0359/4 ..... N79-30418 #
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NTIS/PS-79/0415/4 ..... N79-30492 #
NTIS/PS-79/0416/2 ..... N79-30493 #
NTIS/PS-79/0427/9 ..... N79-30927 #
NTIS/PS-79/0428/7 ..... N79-30928 #
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NTIS/PS-79/0502/9 ..... N79-30547 #
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NTIS/PS-79/0504/5 ..... N79-30544 #
NTIS/PS-79/0505/2 ..... N79-30548 #
NTIS/PS-79/0526 ..... N79-30453 #
NTIS/PS-79/0572 ..... N79-30586 #
NTIS/PS-79/0574 ..... N79-31080 #
NTIS/PS-79/0581 ..... N79-30413 #
NTIS/PS-79/0582 ..... N79-30414 #
NTIS/PS-79/0585 ..... N79-30707 #
NTIS/PS-79/0586 ..... N79-30708 #
NTIS/PS-79/0596 ..... N79-30838 #
NTIS/PS-79/0599 ..... N79-30495 #
NTIS/PS-79/0615 ..... N79-30171 #
NTIS/PS-79/0616 ..... N79-30172 #

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NWC-TP-6037 ..... N79-30395 #

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ONERA-P-1978-3 ..... N79-30585 #
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ORNL/FE-2 ..... N79-30398 #
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ORNL/SUB-7261/1 ..... N79-30810 #
ORNL/SUB-7556/1 ..... N79-30330 #
ORNL/TM-6574 ..... N79-31093 #

ORNL/TM-6617 ..... N79-31040 #
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ORO-3105-61 ..... N79-31058 #
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OWRT-A-070-WIS(3) ..... N79-30855 #
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OWRT-B-066-ARIZ(1) ..... N79-30703 #

OWRT-C-6279(5227)(1) ..... N79-30700 #

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PB-293365/3 ..... N79-30448 #
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PB-293645/8 ..... N79-31105 #
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PB-294247/2 ..... N79-31104 #
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PB-294974/1 ..... N79-30531 #
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PB-295105/1 ..... N79-30890 #
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REPT-60/589 ..... N79-31031 #

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REPT-77-FM-50-REV-1 ..... N79-30270*#
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RSC-3622-1 ..... N79-30606*#
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SAI-78-076-DEN ..... N79-30965 #
SAI-023-79-565-LJ ..... N79-31044 #
SAI-023-79-566-LJ ..... N79-31038 #

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SAND-78-0404C ..... N79-30342 #
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SAND-78-0665 ..... N79-30908 #
SAND-78-0931 ..... N79-30827 #
SAND-78-0949 ..... N79-30784 #
SAND-78-0955C ..... N79-30780 #
SAND-78-1063 ..... N79-30807 #
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SAND-78-1501 ..... N79-30994 #
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